

Gray Herbarium
Harvard University
DEC 24 1952

ARNOLD ARBORETUM
HARVARD UNIVERSITY

ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION

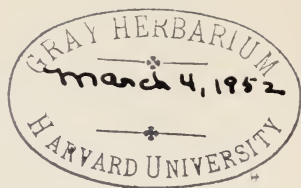
VOLUME XII
1952

PUBLISHED BY THE
ARNOLD ARBORETUM
JAMAICA PLAIN, MASSACHUSETTS



Digitized by the Internet Archive
in 2017 with funding from
BHL-SIL-FEDLINK

ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

MARCH 7, 1952

NUMBER 1

FORTY-FIVE OF THE BEST TREES FOR
MASSACHUSETTS GARDENS*

MASSACHUSETTS has long been a horticultural center where many new plants were first introduced into cultivation. In colonial times this was true of fruit varieties, a little bit later it was true of many rare greenhouse plants, and since the beginning of the twentieth century it has been true of trees and shrubs suitable for enriching the ornamental plantings about the home. Now, there are hundreds of trees being grown in the state, so many that it is frequently most confusing to the home owner to select a few for his own garden. This list of 45 of the "best" trees for Massachusetts gardens is prepared in the hope of stimulating gardeners into becoming acquainted with some of the more unusual trees that are now commercially available.

One fact should be kept in mind however, before taking the following list at its face value. There are many trees commonly grown in Massachusetts, some native and some exotic, that will always be serviceable. New trees may be glowingly described in the catalogues, but these common favorites have served reliably for many years and probably will continue to do so for many more. These are among the trees that every gardener should know and use for one reason or another. Nothing is meant to be implied in the following discussion of the 45 selected types that would cast a shadow of doubt on the serviceability of these, a few of which are listed on pages 19 and 20.

* This list was prepared at the request of the Horticultural Committee of the Garden Club Federation of Massachusetts, five of the trees to be discussed at each of the nine meetings of the horticultural chairmen throughout the year. Because of wide-spread interest in this list it is here produced for the benefit of ARNOLDIA subscribers, and is a companion list to that published in ARNOLDIA for March 11, 1951, describing forty-five of the best shrubs for Massachusetts gardens. It is not perfect, and many may take exception to it. However, it does include forty-five top-notch trees that can be used more in our gardens today. Most important, *all are available in 1952 from local nurseries!*

Keeping these trees very clearly in mind, let us consider some that are not as easily found, either in gardens or commercial nurseries. It is especially important to note that each plant in the following list is available from at least one of the listed nurserymen. It was impossible to contact all the nurserymen in the state so there are undoubtedly many other sources for these plants than those listed. Since they are available, your local nurseryman can obtain them for you if he will.

It is useless to become enthusiastic about a plant that is unobtainable. Each one of these is available in 1952. Consequently, the gardeners of the state are urged to become acquainted with some of these better trees, buy a few that are hardy (for all are not completely hardy in all parts of the state) for planting in order to become better acquainted with them, and in this way increase the beauty and interest of the plantings about their homes.

Forty-five of the Best Trees for Massachusetts Gardens

<i>Abies homolepis</i> 1,4,6,9,10	<i>Malus</i> "Dorothea" 5,8
— <i>koreana</i> 4	— <i>hupehensis</i> 4,5,6,7,8,9
<i>Acer circinatum</i> 5,10	— <i>purpurea aldenhamensis</i> 6,7
— <i>griseum</i> 5,6	— — <i>lemoinei</i> 3,5,6,8,10
— <i>palmatum atropurpureum</i> 1-10	— <i>toringoides</i> 6
— <i>platanoides columnare</i> 1,5,6,7,8	<i>Oxydendrum arboreum</i> 1-8,10
— — "Crimson King" 1,2,3,4,7,8	<i>Parrotia persica</i> 5
— <i>rubrum columnare</i> 1,2,4,6,7,8,9,10	<i>Phellodendron amurense</i> 4,5,6
<i>Albizzia julibrissin rosea</i> 5,6,10	<i>Picea asperata</i> 4,6
<i>Amelanchier laevis</i> 4,5,8	— <i>omorika</i> 4,5,6,9
<i>Cedrus libani</i> 4,5,6,7	<i>Pinus bungeana</i> 5,6
<i>Cercidiphyllum japonicum</i> 2,5,6,7,8,9	— <i>thunbergi</i> 2,4,6,7,8
<i>Cercis canadensis alba</i> 5,6	<i>Prunus avium plena</i> 6
<i>Elaeagnus angustifolia</i> 2,4,6,7,8,10	— <i>serrulata</i> "Amanogawa" 5,7,8
<i>Evodia danielli</i> 5,6	— — "Fugenzo" 7
<i>Gleditsia triacanthos</i> "Moraine" 1-4,6-9	— — "Kwanzan" 1,2,7,8,9
<i>Halesia monticola</i> 4,5,6,7,8,10	<i>Pseudolarix amabilis</i> 5
<i>Ilex pedunculosa</i> 5,10	<i>Sciadopitys verticillata</i> 3,5,7
<i>Kalopanax pictus</i> 6,8	<i>Sophora japonica</i> 1,4,5,6,7,8,10
<i>Koelreuteria paniculata</i> 1,4,5,6	<i>Stewartia koreana</i> 5
<i>Larix leptolepis</i> 4,7,8	<i>Syringa amurensis japonica</i> 1,3-7,9
<i>Magnolia denudata</i> 6	<i>Thuja plicata</i> 4,6,10
— <i>virginiana</i> 5,6,7,8,9,10	

Sources for Trees Listed

1. Adams Nursery, Inc., Westfield, Mass.
2. Bay State Nurseries, North Abington, Mass.
3. Cherry Hill Nurseries, West Newbury, Mass.

4. Harlan P. Kelsey, Inc., East Boxford, Mass.
5. Kingsville Nurseries, Kingsville, Maryland
6. Henry Kohankie & Son, Painesville, Ohio
7. Littlefield-Wyman Nurseries, 227 Centre Ave., Abington, Mass.
8. Weston Nurseries, Inc., Weston, Mass.
9. Wyman's Framingham Nurseries, Framingham, Mass.
10. Tingle Nurseries, Pittsville, Maryland

Forty-five of the Best Trees for Massachusetts Gardens

Hardiness note: Trees listed as hardy in Zones 2, 3 and 4 are hardy throughout most of Massachusetts; those hardy in Zone 5 can be safely grown only in the southern, eastern, and southeastern parts of the state.

<i>Abies homolepis</i>	90'	Zone 4	Nikko Fir
-------------------------------	-----	--------	-----------

One of the best firs for ornamental planting. Easily distinguished from other firs because of the horizontal decurrent lines along the one year twigs. Dark green, vigorous — an excellent conifer for use in any landscape where it can be given plenty of room to grow naturally. Like all other firs, this Japanese native is stiffly pyramidal in outline with definitely horizontal branches.

<i>Abies koreana</i>	50'	Zone 5	Korean Fir
-----------------------------	-----	--------	------------

This tree grows very well but few trees in this country have reached their mature height. It grows more slowly than some of the others and might be the only one considered for small gardens because of this fact. It is stiff and formal but the whitish undersurface of the needles shows to good advantage. A native of Korea and introduced into America in 1918 by the Arnold Arboretum, it too, is stiffly pyramidal in habit.

<i>Acer circinatum</i>	25'	Zone 5	Vine Maple
-------------------------------	-----	--------	------------

A native maple of the Pacific Coast adapted for use in gardens because of its small, compact size and its ability to grow in partially shaded situations especially under evergreens. It is somewhat similar in habit to *A. palmatum* except that its stems twist and turn in a most interesting manner, thus giving rise to its name. The wood is very tough — the Indians, according to legend, used the wood to make fish hooks.

<i>Acer griseum</i>	25'	Zone 5	Paperbark Maple
----------------------------	-----	--------	-----------------

Very difficult to propagate in quantity because only a very small proportion of the seed develops. Otherwise, it could easily be one of the most popular maples. The bark is cinnamon-brown and exfoliates in paper-thin strips similar to that of certain birches. This bark characteristic is easily noticeable from some distance

away, making this tree of outstanding interest throughout the entire year. It is hoped that a reliable method can be found for propagating this plant on a large scale for it certainly merits wide use and has been growing in the Arnold Arboretum for fifty years.

Acer palmatum atropurpureum 20' Zone 5 Bloodleaf Japanese Maple

This is one of the best forms of the Japanese Maple. Frequently these forms are not asexually propagated but grown from seed, a very poor practice. The true Bloodleaf Japanese Maple keeps its good red foliage color throughout the entire growing season and is fairly hardy in Massachusetts. It is well worth trying to obtain the true form, since so many of the substitutes either will not keep the foliage color or are injured by winter cold.

Acer platanoides columnare 90' Zone 3 Columnar Norway Maple

This columnar variety of the commonly planted Norway Maple, has all the good traits of the latter and in addition a very narrow habit. Trees 20-30 feet in height may be less than ten feet in diameter of branch spread. For tall, narrow accent points on the small property or for trees along narrow streets, this city dweller is excellent.

Acer platanoides "Crimson King" 90' Zone 3

This is a seedling of *Acer platanoides schwedleri*, originating at Orleans, France, in the nurseries of Barbier and Company. It was first introduced into America by the Gulf Stream Nurseries, Wachapreague, Virginia, in 1948, and has been patented (No. 735) by this company. This tree is far superior to the Schwedler Maple, in that it keeps its rich purplish red foliage color throughout the entire growing season. Up to the time this clone became available, the Schwedler Maple had proved popular for its colored foliage; but, as many know, this color, while a pronounced red in the early spring, gradually turns greenish in the summer. During the four growing seasons that "Crimson King" has been growing in the Arnold Arboretum, it has kept its color uniform throughout the entire period of growth, from spring to fall. Consequently, it is an excellent shade tree in situations where its colored foliage is thought desirable.

Acer rubrum columnare 60' Zone 3 Columnar Red Maple

Like the Red Maple in foliage and texture, but densely upright in habit. It is not as narrow as the Columnar Norway Maple but is a fast growing type.

Albizzia julibrissin rosea 36' Zone 5 Silk Tree

This tree of exceedingly dainty foliage and flowers is now threatened in the South with a serious wilt disease which kills the tree. This fungus occurs in the soil and infests the tree through the roots. Many clones are being tried and some



PLATE I

The Umbrella Pine, *Sciadopitys verticillata*, makes an excellent dense, pyramidal evergreen specimen.

have been found to be very resistant to the disease. Fortunately it may not affect trees grown in the northern states at all. The hardy variety *rosea* is probably like the species in that it is difficult to get established at first. Since vegetative growth is made late in the season it can be killed somewhat during very cold winters.

Although it can be grown on many soils, the Arnold Arboretum has found that it does well on poor, dry, gravelly soils and so has an important use.

Being a legume, the seed is borne in small flat pods. The flowers are conspicuous, not because of petals (which are insignificant) but because of inch long pink colored stamens, borne in ball-like clusters. The plant has the very desirable trait of opening its flowers consecutively throughout the summer months. The plants growing in Boston start to bloom about July 15th and are continuously in bloom until early September — a long flowering period which cannot be matched by any other northern ornamental tree. The leaves fall at the first frost without changing color.

A splendid ornamental tree, very much worth experimenting with in the North (hardy variety only) until just the right soil and winter protection are found so that it will live over the first few winters and become a sizeable plant. The tree blooms early in life, sometimes when the seedlings are only two to three years old. Propagation is easily accomplished by 3 inch root cuttings made in very early spring using roots that are $\frac{1}{3}$ inch or more in diameter. Smaller roots do not root nearly as well.

Amelanchier laevis	36'	Zone 4	Alleghany Serviceberry
---------------------------	-----	--------	------------------------

A small native tree, delightfully prominent in the very early spring when its profuse white flowers appear before the leaves. The orange to scarlet autumn color brings it into prominence a second time in the year, and its light gray bark is especially distinctive. Admittedly a native, this tree has several qualities (other than its short-lasting flowers) suggesting that it should be used more in naturalized plantings.

Cedrus libani	120'	Zone 5	Cedar of Lebanon
----------------------	------	--------	------------------

Widely grown throughout the South, it was not until the Arnold Arboretum sent a special expedition to Asia Minor in 1903 to collect seed at the highest altitudes where these trees were native that plants could be perfectly hardy in the northeastern United States. Mature trees are very wide at the base, but trees of 30-40 years of age have about the same dimensions as *Abies concolor*, although they are not nearly as dense. The dark green foliage, stiff habit, picturesque and rigidly upright cones, some of which are usually on the tree since they take two years to mature, give this tree a popular interest. Frequent reference is made to it in the Bible and Solomon's Temple was supposed to have been built with its massive timbers. It does not produce much shade and certainly is very formal in



PLATE II

The Amur Cork tree, *Phellodendron amurense*, has cork-like bark that is distinctive throughout the year.

habit, but apparently has great popular appeal nevertheless. This hardy strain is the only form of true cedar reliably hardy in Massachusetts.

Cercidiphyllum japonicum	60-100'	Zone 4	Katsura Tree
---------------------------------	---------	--------	--------------

A wide spreading tree with foliage very much like that of *Cercis canadensis* usually growing with several main stems or trunks. The flowers are insignificant, but the small dry fruit capsules on the pistillate trees—the sexes are separate—remain on the tree most of the winter. The rounded leaves are nearly 4 inches long. Valued as a shade tree because of its wide-spreading habit but also valued because of the rather loose foliage which allows for a great amount of air circulation. An excellent specimen tree of particular value for its graceful leaves which remain unattacked by any insect pest throughout the entire season. Normally wide-spreading in habit, it has been used as a substitute for Lombardy Poplar (see Plate VI) when grown with a single trunk.

Cercis canadensis alba	36'	Zone 4	Eastern Redbud
-------------------------------	-----	--------	----------------

A common sight in the eastern United States, especially in the woods of Pennsylvania, Maryland, and Virginia when it blooms early in the spring is the Redbud. It is often planted with the Flowering Dogwood, blooming at the same time. The white flowered variety is almost as hardy as the species, and certainly worthy of wider use.

Eleagnus angustifolia	20'	Zone 2	Russian Olive
------------------------------	-----	--------	---------------

The flowers and fruits of this plant are none too conspicuous, but the gray foliage is outstanding and the plant can be used for this one feature. Hardy and vigorous, it grows easily in many kinds of soils and its unique crooked trunk can easily be of interest in its own right for it is covered with a brown shredding bark which is of considerable interest throughout the winter.

Evodia danielli	25'	Zone 5	Korean Evodia
------------------------	-----	--------	---------------

The Korean Evodia is fast becoming of interest because of its late summer flowers, at a time when few woody plants are in bloom. The flower clusters, nearly 6 inches across are made up of many small whitish flowers quite similar to the flowers of *I'iburnum lentago*. This might be considered a "new" tree for the small garden, especially where late summer bloom and early fall fruits (red) are desirable. As a street tree it will not prove satisfactory for its wood is comparatively weak and splits easily, and apparently is a short-lived tree (15-40 years).

Gleditsia triacanthos "Moraine"	100'	Zone 4	Moraine Honey-locust
--	------	--------	----------------------

The thornless variety of the Honey-locust has been widely recommended as a substitute for the American Elm because it can be grown in so many situations. The long twisted pods of the species are interesting for they remain on the tree



PLATE III

Kalopanax pictus is an excellent foliage tree, but as yet very rare in American gardens. Its fruits, in the late fall, are most attractive to birds.

long after the leaves fall, yet under certain conditions can be troublesome since they must be raked off. It is not subject to borers as is the true Locust (*Robinia*), has no particularly interesting flowers nor autumn color. The new variety "Mo-raine," developed and patented by the Siebenthaler Nursery Company of Day-ton, Ohio, is thornless and is said to be sterile, hence no fruit pods are developed. This observation is based on the original tree which is over fifteen years old and 16 inches in diameter.

Halesia monticola 90' Zone 5 Mountain Silverbell

With larger flowers than the Carolina Silverbell this species and its pink-flowered variety are planted more because they are more easily seen when in bloom. The pendant flowers, appear all along the twigs of the previous year's growth before the leaves appear making a well grown tree a unique and beautiful sight when in bloom. At other times of the year, the tree is not meritorious but it has no serious insect or disease pests, an important point to consider where annual maintenance and careful supervision will not be given. Because of its loose foliage, and comparatively small flowers, it might best be used where it can be closely observed, or else planted with an evergreen background of white pine or hemlock.

Ilex pedunculosa 30' Zone 5 Longstalk Holly

This is one of the hardiest of evergreen hollies, and should be better known especially in northern gardens. The fruits are often as large as those of *I. aquifolium*.

Kalopanax pictum 90' Zone 4

This tree should be grown much more than it is. Typically a tall, rounded tree, its large maple-like leaves give it somewhat a tropical appearance, and a deep rich soil with plenty of moisture seems to be much the best for good growth. Some of the younger branches and vigorous shoots have sharp prickles, but most of these disappear at maturity. The small balls of flowers appearing in the late summer are unique, and the small black fruits are quickly eaten by birds. Possibly the reason it is not grown more is because of the fact that the seeds take two years to germinate and there are very few fruiting trees in this country, even though it has been growing here for almost a century. A good shade tree devoid of insect and disease pests it should be planted more widely.

Koelreuteria paniculata 30' Zone 5 Golden-rain Tree

This and the Laburnum are the only trees with truly yellow blossoms that can be grown in the Arnold Arboretum. It is quickly and easily grown from seed and its large, upright and pyramidal, conspicuous flower clusters in early summer, followed by its equally conspicuous fruits, make it prominent throughout the summer period when most other trees have few if any flowers or colored fruits. It is

being used a great deal in the Ohio Valley, even as a street tree. Because of its weak wood, this might be none too advisable. It has no autumn color and unless desired specifically for its summer bloom, other trees might be used instead which would have a longer life of ornamental usefulness. This much must be said in its behalf, however, it does seem to grow well in a wide range of soils.

Larix leptolepis 90' Zone 4 Japanese Larch

This is the best ornamental among the larches and seems to grow faster than some of the other species. However, it is not immune to the various troubles which plague most of the larch species, but it is less susceptible to canker disease than are the European and American Larch.

Magnolia denudata 45' Zone 5 Yulan Magnolia

Many people have learned to know this excellent tree under another name, *M. conspicua*, now superseded by the name *denudata*. It has been cultivated in the gardens of central China since the earliest times — a splendid tree with large pure white conspicuous flowers in early May and should not be crowded by other plants but given plenty of room in which to develop. This means it should be allowed a ground space of about 30'.

Magnolia virginiana 60' Zone 5 Sweet Bay

The very fragrant, waxy white flowers appearing in June and early summer, the gray bark and good foliage with leaves white on the undersurface, make this an attractive native species. In the deep South this plant is a tree and nearly evergreen, but in New England it is much more shrubby and deciduous. It can be grown well in wet soils, although it does not require such situations to grow well — an excellent native plant.

Malus "Dorothea" 25' Zone 4

This seedling was first noted in bloom when it was 5 feet high. The foliage resembles the Parkman Crab Apple somewhat, while the fruit resembles that of *M. arnoldiana*. It is one of the very few semi-double flowered crab apples which also bear fruit, and particularly beautiful yellow fruit, $\frac{1}{2}$ inch in diameter. Another very important characteristic is the fact that it bears double, slightly pinkish flowers annually, something which unfortunately cannot be claimed by all crab apples. Also it blooms early in life, young plants grafted one year frequently bloom the next.

Malus hupehensis 24' Zone 4 Tea Crab Apple

The Tea Crab Apple is the most picturesque of all crab apples because it is vase shaped in habit with long-reaching single branches growing from the trunk and spreading out like the ribs of a fan. In bud and flower, it is beautiful and its



PLATE IV

Top: The flowers of the Silverbell, *Halesia monticola*. Bottom: Flowers of the oriental cherry "Fugenzo" one of the few which can be planted in the warmer parts of Massachusetts.

marked habit is clearly evident every season of the year. The white flowers are produced on small spurs or short branches up and down the entire length of the long straight branches; the red fruits are small and not especially colorful.

Malus purpurea aldenhamensis 25' Zone 4 Aldenham Purple Crab Apple

Superior to the Purple Crab Apple because of a large number of petals (5-8), hence a longer period effective in flower. It frequently bears a few flowers a second and even a third time.

Malus purpurea lemoinei 25' Zone 4 Lemoine Purple Crab Apple

Lemoine's Crab Apple has the darkest red flowers of any of the *Malus* species. It is decidedly ornamental, and is prominent anywhere. It is far superior to *M. purpurea* or *M. pumila niedzwetskyana* because of the darker colored flowers and also because they do not fade nearly as much.

Malus toringoides 25' Zone 5 Cutleaf Crab Apple

One of the last crab apples to bloom (late May) and one of the best in fruit--the pear-shaped fruits being colored red and yellow remain on the plant in splendid condition until after the first hard freeze. E. H. Wilson used to consider this the best of all species in fruit, but because its flowers are pure white it must be admitted that there are several superior to it for colorful flowers.

Oxydendrum arboreum 75' Zone 4 Sorrel Tree or Sourwood

This is one of the superior ornamental trees especially while it is young and can be kept clothed with branches from top to bottom and grown in a situation where it is exposed to full sunshine. Its leaves are similar in size and shape to those of Mountain-laurel; they are lustrous and effective throughout the growing season. The late summer flowers, brilliant scarlet autumn color and graceful pyramidal habit give this tree additional interest every season of the year.

Parrotia persica 50' Zone 5 Persian Parrotia

An excellent tree for foliage, it usually grows with several trunks from the base and has leaves somewhat similar to those of the Witchhazel but more lustrous. The flowers, appearing before the leaves, are insignificant, but the interesting bark flakes off in patches leaving a colorful trunk like that of the *Stewartias* or *Pinus bungeana* giving it special interest in winter. Also the branches tend to be more or less horizontal and covered with leaves all in one plane. When allowed to grow with branches to the ground, older specimens can become very graceful indeed. This tree is not apparently infested with any serious insect or disease pest and might well be grown considerably more than it is.



PLATE V

Top: The southern Sourwood, *Oxydendrum arboreum*, has flowers in late summer.
Bottom: The Japanese Snowbell, *Styrax japonica*, blooms in early June.

Phellodendron amurense	45'	Zone 3	Amur Cork Tree
-------------------------------	-----	--------	----------------

There has been some misunderstanding about the *Phellodendron* species, because C. S. Sargent states back in 1905 that *P. sachalinense* was best under cultivation. This statement has since been copied by many authors. The fact of the matter is that of the five species growing in the Arnold Arboretum *P. amurense* has been outstanding and C. S. Sargent has noted this in some of his writing in 1924. The other species are similar but *P. amurense* has the large branches of picturesque habit and corky bark which is of interest all winter. Like other species in this genus the sexes are separate and only pistillate plants will bear the numerous clusters of black berries. The autumn color is only of passing interest since the leaves quickly drop once they have turned yellow. It is a vigorous growing tree and easily and quickly grown from seed (seedlings are continually sprouting up all over the Arnold Arboretum—more so than any other plant) and the roots are fibrous, making it easy to transplant. This wide-spreading tree produces only light shade and is of little interest in flower, but of particular interest in winter because of the massive branches and interesting bark.

Picea asperata	75'	Zone 5	Dragon Spruce
-----------------------	-----	--------	---------------

Somewhat similar to the Norway Spruce in general appearance while young, this tree is finding a place for itself in seaside planting where it does better than most spruces. The needles of this species remain on the tree approximately seven years, the main reason why the foliage is so dense.

Picea omorika	90'	Zone 4	Serbian Spruce
----------------------	-----	--------	----------------

One of the best spruces for landscape planting. It has done very well indeed in the Arnold Arboretum since it was first introduced there seventy years ago. Its dense habit, and very beautiful glossy green needles, which show much of their whitish under-surfaces as they move in the wind, make it decidedly beautiful the entire year. Some of the trees have pendant branchlets which add materially to its beauty. The Serbian Spruce can be termed almost columnar in habit, for old plants in the Arnold Arboretum 60 feet tall have a branch spread of no more than 15 feet at the base. If only one spruce is to be chosen for a planting this should certainly be considered first.

Pinus bungeana	75'	Zone 4	Lace-bark Pine
-----------------------	-----	--------	----------------

A rather slow growing, dark green foliage tree, with excellent possibilities as a specimen plant because of its habit of growth and interesting bark. Very young plants will show the characteristic for exfoliating bark when the branches are only an inch in diameter. Also, this tree has the most desirable trait of holding its needles about five years, longer than most pines. Consequently this excellent specimen pine should be planted considerably more than it is. Its picturesque habit of growth with several major trunks, is also one of its desirable traits.



PLATE VI

Top: The Japanese Tree Lilac, *Syringa amurensis japonica*, blooms in mid-June.
 Bottom: The Katsura tree, *Cercidiphyllum japonicum*, when grown with a single trunk can be very columnar in habit (three trees on left). Grown with several trunks (two trees on right) it is very wide-spreading and rounded.

Pinus thunbergi 90' Zone 4 Japanese Black Pine

The best pine, possibly the best evergreen, for planting along the seashore in the northeastern United States, is this Japanese Black Pine. It has done very well on Nantucket and Martha's Vineyard where other plants have failed, for it withstands salt laden winds right off the ocean remarkably well.

Prunus avium plena 60' Zone 3 Double Flowered Mazzard Cherry

This splendid tree has been in North America nearly 75 years but it is still not seen very often. Its beautiful double white flowers, nearly $1\frac{1}{2}$ inches in diameter, appear in early May and are not borne profusely but they do remain effective for a very long time — nearly a week longer than those of the single flowered Mazzard Cherry, which is of course widely planted for its fruits. All Mazzard cherries do best when grown in the full sun, for in the shade, only a very few flowers appear.

Prunus serrulata "Amanogawa" 20' Zone 5

"Amanogawa" is the only truly fastigiate oriental cherry worth growing. Usually not over 20 feet tall, flowers $1\frac{3}{4}$ inches semi-double, light pink and fragrant. The varietal name means "milky way" an indication of its floriferous blooms. David Fairchild is credited with first introducing this from Japan in 1906. It is interesting to note that a very high percentage of the seedlings of this tree are identical with the mother plant in form and flowers.

Prunus serrulata "Fugenzo" 20' Zone 5

This popular variety is also found in nursery catalogues under the name of "James H. Veitch" and also "Kofugen." The Japanese name translated means "goddess of a white elephant." The flowers are as much as $2\frac{1}{2}$ inches in diameter, rosy pink fading to a light pink, double with about 30 petals, blooming at about the same time as "Kwanzan." It is rather wide-spreading in habit.

Paul Russell in his excellent work on the "Oriental Flowering Cherries" notes that it was known to the Japanese 500 years ago and is still widely planted. It is often confused with "Shiro-fugen" but the flowers of this last variety fade.

Prunus serrulata "Kwanzan" 25' Zone 4

This is probably the most popular and the most hardy of all the double flowered oriental cherries. The deep pink double flowers are $2\frac{1}{2}$ inches in diameter and have 30 petals. They are borne on a fairly upright growing tree about 12–18 feet tall. The young foliage, as it first appears, is a bright reddish copper color, adding considerably to the colorful display of this tree in early spring. Probably the best display is at Washington, D.C., along the Tidal Basin where nearly 200 trees of this one variety alone are growing.

Pseudolarix amabilis (kaempferi) 120' Zone 5 Golden Larch

The Golden Larch is one of the most beautiful exotic trees. Originally found by Robert Fortune growing in pots for ornament in China and eleven years later he found it growing naturally in a monastery garden. Unfortunately it has never become popular in America, possibly because it is not a tree for the small garden, since trees even up to 30 and 40 feet are almost as broad as they are tall! Also it is very likely that seed sources, especially in this country are very limited. Our trees have a good crop of seed only about every three or four years. On large estates or in parks, it can quickly become a beautiful specimen, interesting because of its beautiful foliage throughout the spring and summer. In the late summer, when the cones begin to mature, these too are interesting and in the fall its beautiful golden yellow autumn color is very outstanding even though it is of short duration.

Sciadopitys verticillata 120' Zone 5 Umbrella Pine

This very beautiful tree, easily grown and not susceptible to any serious disease, is valued for its dense habit and very dark evergreen foliage. Twenty to thirty of the needles are arranged in whorls about the twigs somewhat similar to the ribs of an umbrella, from which similarity it gets its common name. These needles remain on the tree 2-3 years before falling off, and one of its good points is that it keeps its lower branches for a long time and so makes a splendid lawn specimen. Although growing tall in Japan, it is rather slow growing in this country and plants fifty years old in the Arnold Arboretum are still only 25 feet high. It should have good soil and not be planted in hot, dry situations.

Sophora japonica 75' Zone 4 Japanese Pagoda Tree

This is a good shade tree with alternate compound leaves a dark green color. The common name comes from the fact that it is frequently used around Buddhist temples in the Orient. It is also considerably used there as a wide-spreading street tree, with several desirable qualities. It blossoms in late summer, with large pyramidal clusters of yellowish pea-like flowers that are most conspicuous. It is the last of the larger trees to bloom, and so is greatly desired as an ornamental. One excellent quality is its apparent ability to withstand city conditions. Old trees have much the same general rounded habit as the White Ash. The yellowish pods, following the flowers, frequently remain on the tree all winter. A desirable large tree, it should be used considerably more than it is.

Stewartia koreana 45' Zone 5 Korean Stewartia

Smaller growing than *S. pseudo-camellia* but with larger flowers and just as interesting winter bark, this Korean Stewartia is very difficult to find in gardens. The conspicuous early summer flowers that are pure white and 3 inches in diameter with golden centers, make it a useful small tree for bloom when few trees are

in flower. The habit is densely pyramidal. It is unfortunate that this excellent specimen is extremely difficult to find for it has been flourishing in the Arnold Arboretum where it is perfectly hardy, ever since 1917 when it was first introduced.

The striking bark, irregularly flakes off in pieces, the older darker bark on the outside of the trunk breaking off to disclose the inner lighter colored bark beneath it, somewhat similar to the bark of the Sycamore or *Pinus bungeana*.

Syringa amurensis japonica 30' Zone 4 Japanese Tree Lilac

This Japanese Lilac can be grown as a tree with a single trunk and it is of special value because of the late bloom of the creamy white pyramidal flowers in mid-June. The shiny cherry-like bark is interesting in the winter, the large leaves and conspicuously vigorous habit is striking in the spring and summer, and the large creamy white pyramidal flower clusters, make it an outstanding plant, either as a specimen or in a group as screen or windbreak. The variety differs from the species in being more tree-like in habit, taller and slightly later to flower. It is susceptible to borers and scale infestations which must be kept under control if it is to be a well grown plant, sufficient reason for not using it as a street tree where annual maintenance and close surveillance are necessities. This is the only native Japanese tree which F. L. Skinner can grow in the severe climate of Dropmore, Manitoba, Canada.

Thuja plicata 180' Zone 5 Giant Arbor-vitae

This arbor-vitae is the best of the arbor-vitae because its lustrous evergreen foliage does not turn brown in the winter as does the foliage of most of the *T. occidentalis* varieties. Commercial growers in the northeastern United States have learned that it is necessary to use seed collected from plants high in the mountains of Montana and Utah, for plants grown from seed collected on the Pacific Coast have not proved hardy in the East. The Giant Arbor-vitae is a splendid tree, large or small, and can be kept restrained at almost any height by proper clipping.

Among the Best Common Trees

Abies concolor 1, 2, 3, 4, 5, 6, 7, 8, 10
Acer ginnala 2, 4, 6, 7, 9, 10
 — *platanoides* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *saccharum* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Amelanchier canadensis 1, 2, 4, 5, 6, 7, 8
Betula lenta 4, 6
 — *papyrifera* 1, 3, 4, 6, 7, 8, 9
Carya ovata 6, 10
Chamaecyparis obtusa 6, 7, 8, 10
Cladrastis lutea 1, 2, 3, 4, 5, 7, 8, 9

Cornus florida 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *kousa chinensis* 2, 5, 6, 7, 8
Crataegus crusgalli 1, 2, 3, 4, 6, 7, 8
 — *oxyacantha pauli* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *phaenopyrum* 1, 2, 4, 5, 6, 7, 8, 9
Fagus species and varieties 1, 2, 4, 5, 6, 7, 8, 9, 10
Ginkgo biloba 1, 2, 5, 6, 7, 8, 10
Ilex opaca 5, 6, 7, 8, 10
Juniperus virginiana 2, 4, 6, 7, 8, 10
Laburnum vossi 1, 2, 3, 4, 5, 7, 8, 10
Liquidambar styraciflua 4, 5, 6, 7, 8, 10
Liriodendron tulipifera 1, 2, 4, 6, 7, 8, 9, 10
Magnolia soulangeana 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *stellata* 1, 2, 3, 5, 6, 7, 8, 9, 10
Malus arnoldiana 1, 2, 3, 5, 6, 7, 8, 9
 — *atrosanguinea* 1, 2, 3, 4, 5, 6, 7, 8, 9
 — “Eley” 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *floribunda* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — “Hopa” 1, 2, 3, 4, 6, 7, 8, 9, 10
 — *robusta* 3, 4, 5, 6, 7, 8
 — *scheideckeri* 1, 3, 4, 5, 6, 7, 8, 9
 — *zumi calocarpa* 3, 4, 5, 6, 8, 10
Nyssa sylvatica 2, 4, 8
Picea glauca 1, 2, 3, 4, 6, 7, 8, 9, 10
Pinus resinosa 1, 2, 3, 4, 6, 7, 8, 9
 — *strobus* 1, 2, 3, 4, 6, 7, 8, 9, 10
Pinus sylvestris 3, 4, 6, 7, 8, 10
Prunus sargentii 2, 4, 6, 8
Pseudotsuga taxifolia 1, 2, 4, 6, 7, 8, 9
Quercus alba 4, 6, 7, 10
 — *borealis* 2, 3, 4, 7, 8
 — *coccinea* 3, 4, 7, 8, 9
 — *palustris* 1, 2, 3, 4, 6, 7, 8, 9, 10
Sorbus aucuparia 1, 2, 3, 4, 6, 7, 8, 9, 10
Styrax japonica 5, 6, 10
Tilia cordata 3, 4, 7, 8, 9, 10
 — *platyphyllos pyramidalis* 3, 7, 8
Tsuga canadensis 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 — *caroliniana* 1, 4, 5, 6, 7, 8
Viburnum prunifolium 4, 6

DONALD WYMAN

ARNOLDIA



Gray Herbarium
Harvard University

March 24, 1952

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

MARCH 21, 1952

NUMBERS 2-4

NUT GROWING IN THE NORTHEASTERN STATES*

THE Northeastern States have a rich heritage of native nut trees. Among the species occurring in the fields and woodlands are six hickories, the black walnut, the butternut, two species of filberts, the beechnut, and formerly the chestnut. At the present time, however, the species have not been developed in the horticultural sense and so do not form any commercial industry, nor have they been improved by selection and breeding in a way comparable to the Persian walnut or the pecan. The nuts that are grown commercially in America such as the Persian walnut, the pecan, the European filbert, and the almond have all originated either in foreign countries or in the region to the South and West where the climate is better suited for their growth.

The planting of improved nut trees in the northeastern states is thus a comparatively recent development. To be sure nut trees have been given a sort of culture in that they have been left in the fence rows and in the fields that were cleared of other species, and seedling trees have been planted around the home grounds from which nuts have been harvested from time to time. Except with the chestnut it is only within the last quarter century that there has been any attempt to improve the nuts grown and to encourage nut culture in any real sense. Such improvements as have taken place have been the discovery of varieties that bear superior nuts and their propagation and testing. In the Northeast this process is still in the exploratory stage and there is yet much to learn as to the adaptation of the various kinds of nut trees to this region.

As the work has progressed it has become evident that the successful production of improved nuts in the Northeast is largely dependent upon the discovery of varieties that are adapted to this region. Most of the varieties of nuts which have been selected, named and propagated have originated to the South and

* Referring specifically to New England, New York and Pennsylvania. Of course the information would also apply to other regions with similar climate.

West and when brought into the northeastern states have not produced good crops mostly because the climate is not warm enough and the growing season long enough for the normal development of the variety. It seems obvious that for the most part in this region nut culture must be developed from varieties which have originated in the North or in parts of other countries which have a similar climate. The search for varieties adapted to the North has been going on for some time and a considerable number have been named. The time is now ripe for more extended planting of nut trees to determine their adaptability to growth in northern locations. Planting nut trees for shade and as a hobby is to be greatly encouraged because not only are trees of assured hardiness and landscape value available but the grower by testing varieties is contributing to our knowledge of nut culture in the Northeast.

Climatic Factors

With nut trees, as with all other plants, the most important determining factor in their survival and growth is the climate of the region where they are planted. Apparently the limiting factor with many species is winter cold, particularly the absolute low temperatures reached in any one season. Most nut species are long lived trees and although the winters of several decades may not be injurious the occasional exceptional winter may entirely wipe out a given species or variety. This has occurred in parts of the North with the Persian walnut. Previous to 1933-34 there were a considerable number of these trees flourishing in the fruit belt of western New York State, many of which had grown to a bearing size. The unprecedented cold of that season killed most of the trees outright except in a very limited area where the temperature did not fall below -20° F. This temperature is critical not only for most varieties of Persian walnuts but for many varieties of filberts, Chinese and Japanese chestnuts, heartnuts, and some black walnuts. There is little use in planting trees of these varieties if such temperatures are of frequent recurrences. The zones with temperatures above -20° F. over a 15 year period are shown in the accompanying map. (Plate VII)

Another climatic factor that is of real importance in the growing of nut trees is the length of the growing season or the number of days between freezes. Practically no species will stand a hard freeze after the growth starts in the spring. These spring frosts rarely kill the trees outright but destroy the new shoots and with them the year's crop. At Ithaca, N.Y., it is probable that this killing of the new growth on hickories and walnuts is responsible for crop failure more often than any one other factor. The leaves come out from other buds after the freeze and during the growing season the trees appear normal except for the fact that there is no crop. Most of our nut tree species require a growing season of at least 150 days between frosts although butternuts and filberts may require less. The length of the growing season for the various parts of the northeastern states is shown on the accompanying map. (Plate VIII)

Map showing absolute minimum temperatures in
Northeastern states from 1926 to 1940.
A temperature of -20°F . is critical for some
kinds of nut trees.

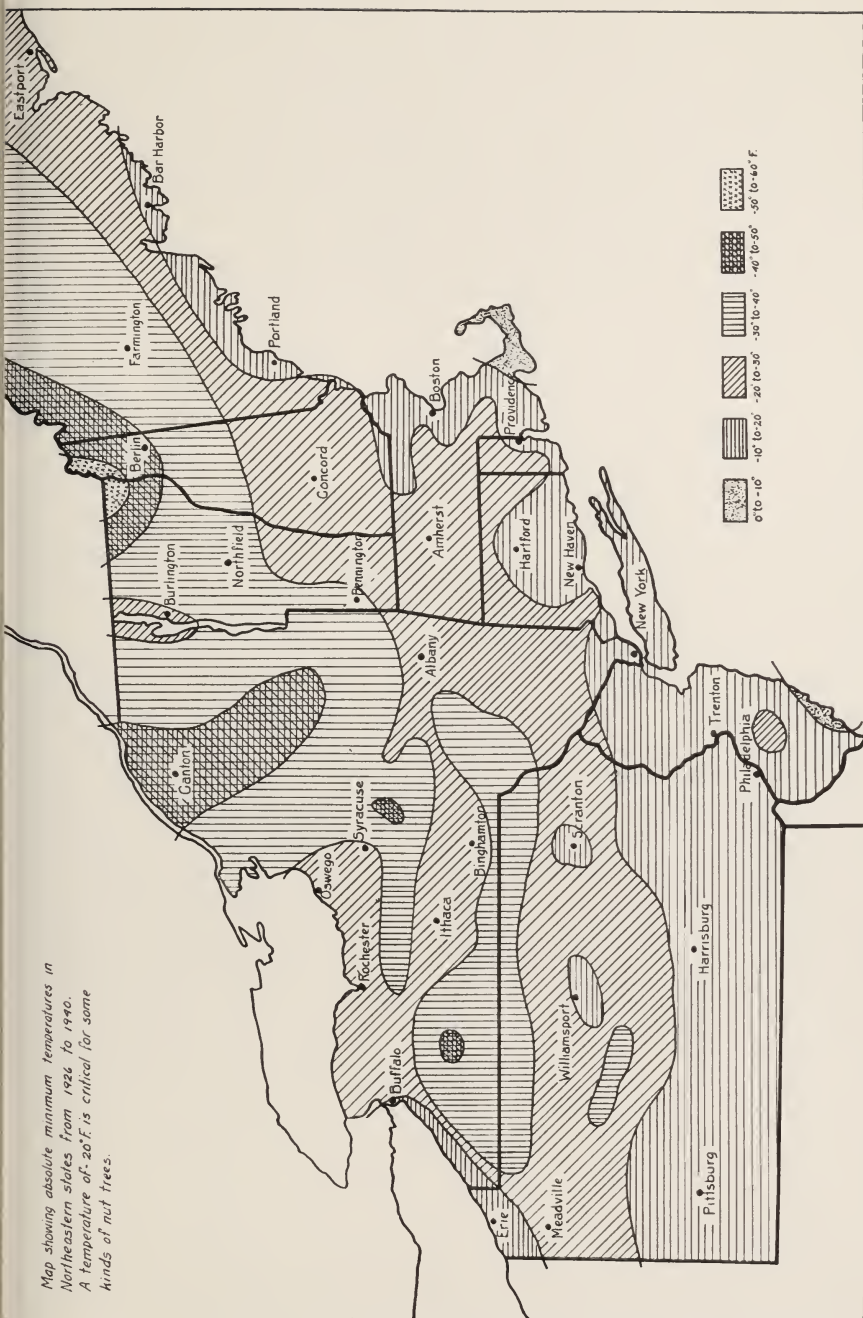


PLATE VII. Note: The maps have been prepared from data supplied from the U.S. Weather Bureau publications modified in the light of other known climatic and geographical features. The zones are only approximate and local conditions such as altitude, exposure and nearness to bodies of water may have an important effect on the growth of trees.

Somewhat less damaging than late spring frosts are freezes which occur in early fall. Black walnuts are particularly likely to be damaged at this time. The nuts on the trees will not be hurt by light frosts but if the temperature goes to $+25^{\circ}$ F. or below there is likelihood that not only will the leaves be frozen off the trees but the nuts themselves will be frozen so as to make them poorly flavored and useless. In many cases if the leaves are frozen from the trees the development of the nuts will stop and the nuts are poorly filled. Early fall freezes, if the drop in temperature is rapid and occurs before the growth on the trees has hardened, may cause serious damage to both trees and nuts.

Associated with the same problem as the length of the growing season between frosts is the mean summer temperature sometimes expressed as total summer heat. Varieties of fruit trees, nuts included, require a certain amount of heat above a base temperature in order to develop well-filled nuts. Thus, even though the growing season may be sufficiently long, if the temperature during the growing season is too low, nuts will not mature. This is particularly important with those species that normally grow farther South such as the northern pecan from Illinois and many of the black walnut varieties. These trees may be perfectly hardy as far as winter low temperatures are concerned but they rarely mature a crop because of cool summers and the short growing season. Sometimes exceptionally warm seasons will mature nut varieties in a region where they usually fail to ripen. The same thing is also true of grapes and other fruits.

Local variations in climate are often important in determining the suitability for growing nut tree species on a particular site. On the accompanying maps the climatic zones are indicated in a general way. Within these zones, however, there may be certain sites which are more favorable for the growth of nut trees than others. These sites are related to proximity to bodies of water, good air drainage, protection from winds or other favorable factors. An example of such a site has been observed at Aurora on Cayuga Lake, N. Y. Here on a certain bench close to the lake and surrounded by rather high banks, a number of species were growing for many years that were not adapted to the surrounding region. These included a California redwood, a number of Persian walnuts and a few northern pecans. These trees had grown to considerable size and had produced satisfactory crops but in the winter of 1933-34 the lake froze over for the first time in many years and the temperature on a single night dropped to an unprecedented low point. All of the trees except the pecans were either killed or badly damaged. Advantage should be taken of such locations wherever they occur. On the other hand exposed hillsides, frost pockets, and high elevations should be avoided.

From the above discussion of climate and an examination of the maps, it becomes evident that parts of the Northeast differ greatly in their suitability for growing nut trees. In northern New England, particularly Maine, New Hampshire and Vermont, only a few of the most hardy kinds such as the butternut can be grown. In southern Pennsylvania, however, most species and varieties will

Map showing on average length for growing season in the Northeastern States. Growing season of at least 150 days between frosts is essential for many kinds of nuts.

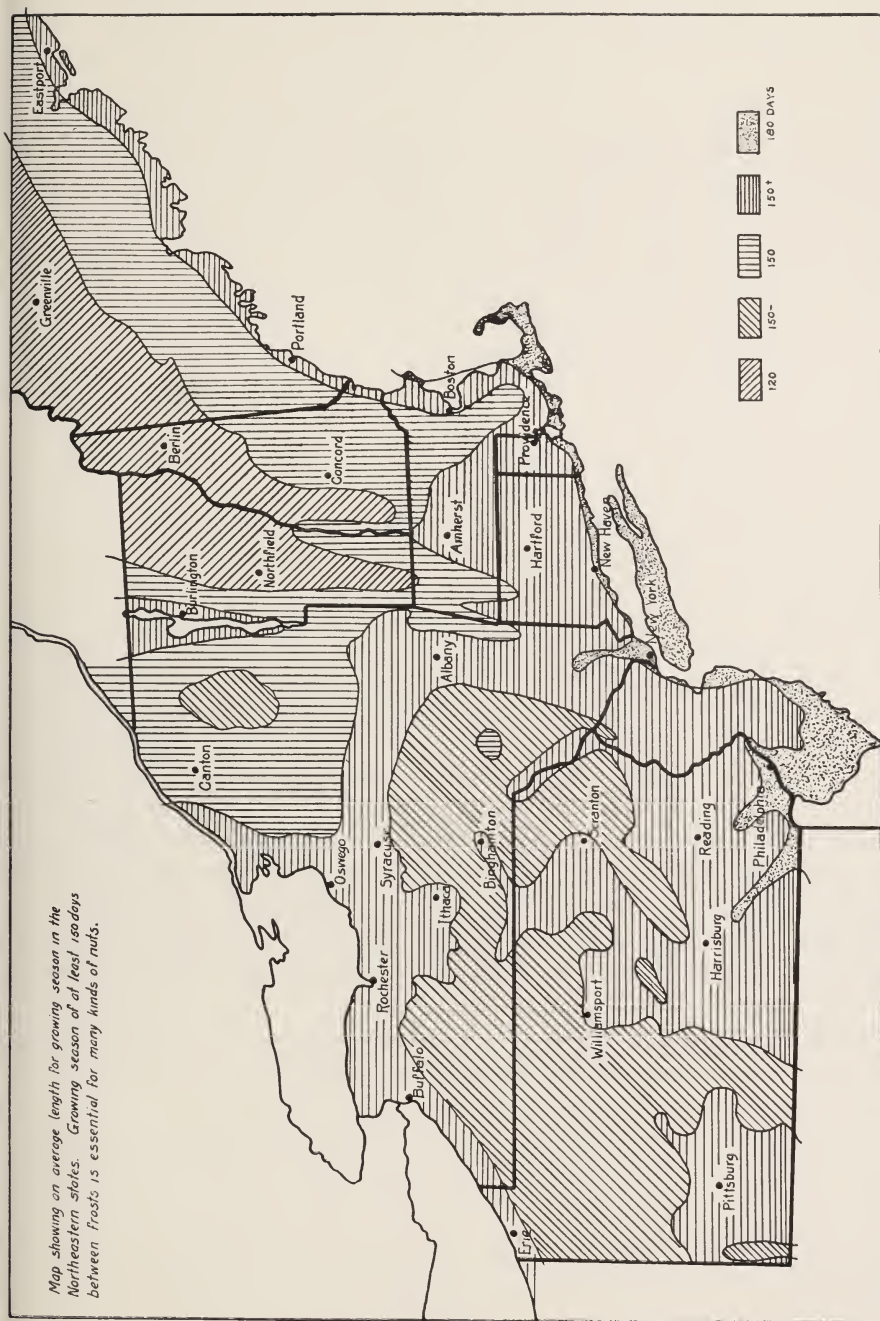


PLATE VIII. See Note under Plate VII.

succeed. In between these areas conditions become increasingly less favorable from South to North, the suitability of any locality being influenced by local factors that effect temperature, air drainage, and the like.

Species and Varieties

As before indicated, the problem of growing nut trees in the northeastern states is largely a matter of varieties and their adaptation. The greatest concentration of the more valuable native species, particularly the black walnut and the shag-bark hickory, is in the Mississippi River basin, particularly the Middle West. Named sorts originating in these regions are probably not adapted to northern New York or New England and should be planted with the realization that it is an experimental project or else there should be assurance based on tests that the varieties will succeed. The probable solution of the problem is to obtain varieties that have originated locally or under similar climatic conditions and are of proven worth.

BLACK WALNUT. The black walnut, although primarily a plant of the Mississippi River basin and the region of the Great Lakes, is hardy in most parts of the Northeast and one of the most valuable nut trees for the region. It is extensively planted around the farmsteads in southern New England and southward and has escaped along the fence rows and in waste places where it is not native. Most of the varieties which have been named and propagated originated to the West and South of New England and have not proved suitable here. At Ithaca, New York, the variety "Thomas" has been one of the most successful but apparently this is about the limit of its northern range and even here there are seasons when the nuts do not mature. Other varieties extensively propagated such as "Ohio" and the "Stabler," do not mature at Ithaca or farther North. Varieties of northern origin have as yet not been sufficiently tested to be sure of their behavior in New England. They are, however, the most promising for this region and are well worth a trial. Among these can be mentioned the "Snyder" from the Ithaca region, the "Wiard" and "Allen" from Michigan, the "Huber" and "Cochrane" from southern Minnesota and the "Cresco" from northern Iowa. These are being propagated sparingly by nurserymen and could be propagated to order if the grower so desires.

Varieties successful in southern New England, central Pennsylvania and southward are the "Thomas," "Elmer Myers," "Stambaugh" and "Sparrow." These are available from nurserymen.

Those interested in nut culture should observe trees growing in the northern part of the black walnut range and select those which produce the best nuts over a period of years. These can be propagated by nurserymen on order or grafted by the individual himself. It is only by such selection from trees that are successful that progress will be made in the varietal adaptation of nuts to a northern environment.

Map showing the average July temperature in the Northeastern states for the years 1926 to 1940. July temperature is a good indication of amount of heat necessary for maturing nut crops.

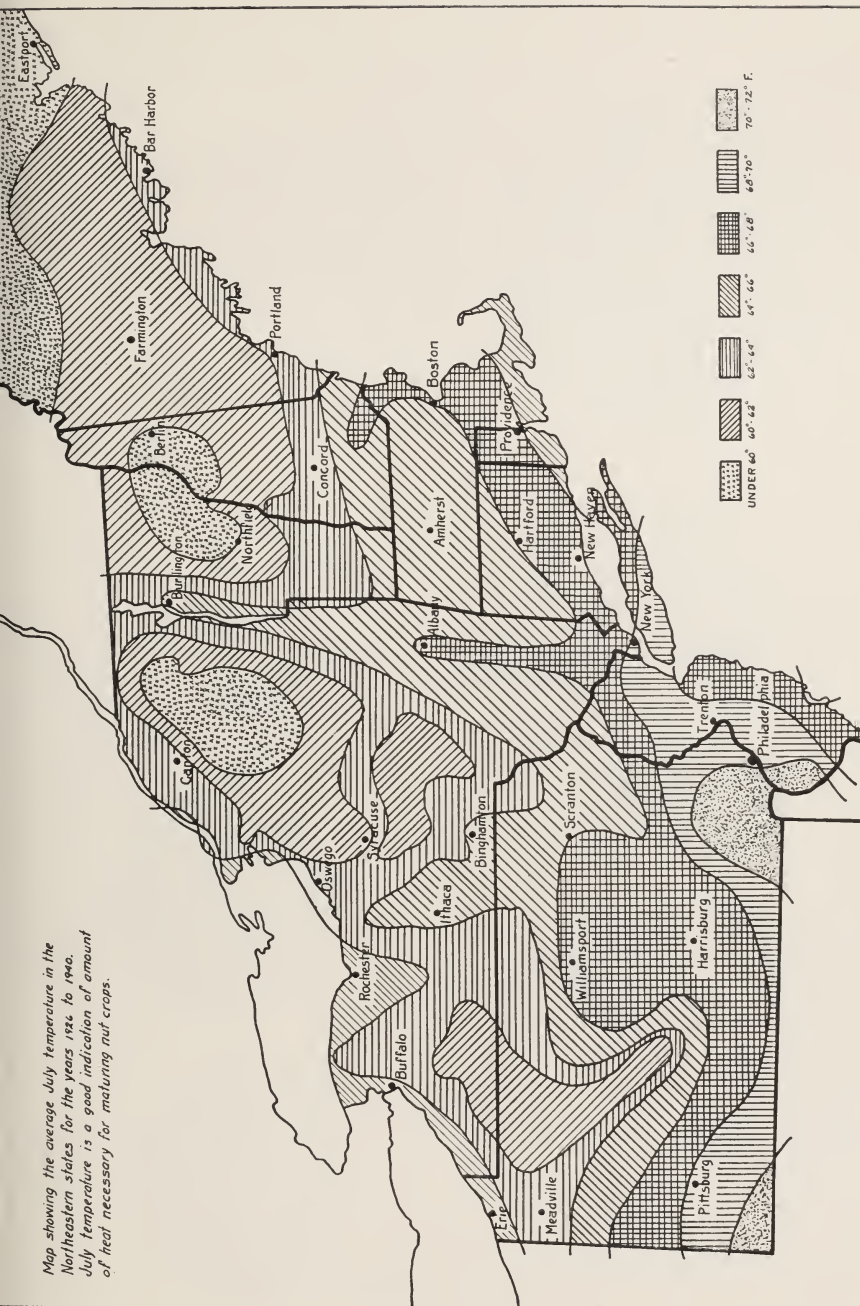


PLATE IX. See Note under Plate VII.

The variation in cracking quality and size of black walnuts is great. Some of the better sorts may have as high as 35% kernel although 20% kernel is good and most common seedlings have considerably less. Black walnuts are best adapted to deep, rich, slightly alkaline or neutral soils with good drainage. They are found growing naturally in alluvial soil in the river valleys. In the North such sites should be avoided if they are "frost pockets."

BUTTERNUT. The butternut extends the farthest North in its natural range of any of the important nut trees and in fact in northern New England is about the only nut which will succeed. Here it should receive much more attention than it has in the past. It has the disadvantage of being rather short-lived under some conditions. The cause of this in some cases is a parasitic fungus but in others it is apparently related to the nature of the tree itself.

Although the butternut will succeed fairly well on the poorer upland soils it thrives best on richer neutral soils with good drainage. A dozen or more varieties have been selected but only a few have been propagated commercially. Some of the named sorts that are propagated by nurserymen, at least in small quantities, are the "Kenworthy," "Irvine," "Love," "Craxey," Thill," and "Craxey Van der Poppen." For some unknown reason the butternut is not easily propagated. Named varieties certainly deserve much more attention than they now receive because of their very superior cracking quality as compared with the ordinary run of seedlings.

PERSIAN WALNUT. Attempts have been made to grow the Persian or English walnut in the Northeast for many years with recurring damage from winter cold. Trees in the protected fruit region of New York became large enough to bear good crops until the extreme cold winter of 1933-34. At that time practically all Persian walnuts in the East were either killed outright or very severely damaged. Apparently the temperatures of -20° F. becomes critical for most trees of this species and quick drops in temperature in spring or fall may be injurious at higher temperatures.

At the present time there is a very real interest in what is known as the Carpathian walnuts which have been introduced from Poland by Mr. Paul Crath of Toronto, Canada. These trees are grown from seeds or grafts from trees in the Carpathian Mountains which have withstood temperatures as low as -40° F. Some of these trees have been growing in North America in both Canada and the United States for fifteen to twenty years and show promise of successful culture. Many seedling trees have now fruited and a few varieties have been named and propagated among them the "Littlepage" and the "Metcalf." A recent contest discovered a number of other superior types that should soon be available. Trees are available mostly as seedlings in both the United States and Canada. It should be borne in mind that even though the Carpathian walnut is hardy there may be other climatic factors which are limiting in their culture, such as length of growing season or the amount of summer heat available. Indications are, however,



PLATE X. Black walnuts. The nuts at the left show large and small variations. The one at the right is the Snyder variety, originating near Ithaca, N. Y., and has good cracking quality. The disk is slightly larger than a twenty-five cent piece.

that they are adapted to relatively short seasons and they have shown little killing back from winter cold. They have however been damaged by late spring frosts.

JAPANESE WALNUT. The Japanese walnut (*Juglans cordiformis ailantifolia*) makes rapid and luxurious growth even in rather poor soils and is well adapted for use as a shade tree. It comes into bearing early and has a tropical appearance which is very pleasing. Seedling trees vary considerably in their hardiness but for the most part withstand winter cold in all except the most severe parts of the Northeast. At Ithaca, many have withstood temperatures of -35° F. without damage. On the other hand there are some seedlings which have been damaged at -20° F., and early fall freezes may be damaging at higher temperatures. The nuts of the Japanese walnut resemble the butternut in flavor of the kernel, but in general are not so highly flavored. Some types of this nut are fairly smooth whereas others are rough much like the butternut. It was thought that these rough nuts were hybrids with the butternut, but the fact that such rough nuts occur in Asia where there are no butternuts indicates that they are probably only a form. The name *huartnut* is used for Japanese walnuts of the rough shelled type. As yet there are no named varieties of this nut.

HEARTNUT. The heartnut (*Juglans cordiformis*) is a sport or mutation of the Japanese walnut resembling it closely in foliage and growth habit. The nuts have much better cracking quality, however, and with most of the named sorts kernels can be recovered in whole halves. The shells of some of them can be split apart with a knife inserted in the base of the nut. The nuts are smooth and attractive in appearance and although usually smaller, they are much superior to the ordinary forms of the Japanese walnut. There is variation in hardiness of the different named varieties and at the present time it is impossible to give a well substantiated opinion as to the adaptation of the named varieties to northern culture. The "Lancaster" has not been hardy at Ithaca. Other sorts in the trade are the "Bates," "Faust," "Ritchie," "Stranger," "Walters," and "Fodermaier." Anyone interested in planting this nut will do a real service by keeping records of their performance and giving the information to experiment stations or the Northern Nut Growers' Association.

HICKORY NUT. A number of species of hickory are native in the Northeast. Among these are the mockernut (*Carya alba*), the shagbark hickory (*C. ovata*), the red hickory (*C. ovalis*), the pignut (*C. glabra*), the bitternut (*C. cordiformis*), and the shellbark hickory or kingnut (*C. laciniosa*). Of these the shagbark hickory is by far the most important. Mockernuts are gathered to some extent from the wild but are undesirable because of their thick shells. The pignut is usually not bitter but with few exceptions is of such poor cracking quality as to be of little value. The bitternut is intensely bitter, astringent, and quite inedible. Some of the hybrids with the shagbark hickory have been propagated because of their thin shells but are of poor cracking quality and flavor. The problem of growing hickory nuts in the Northeast is much the same as with the black walnut. Al-

though many sorts have been named a large part of them have their origin in the South and West, and when brought into the Northeast are not successful because of the short growing season and lack of heat. The Northeast must rely on varieties which have originated in the northern states. Among these may be mentioned "Davis," "Fox," "Glover," "Goheen," "Kirtland," "Mann," "Miller," "Nielsen," "Whitney," "Beeman," "Bridgewater," and "Wilcox." Most of these were reported in some of the nursery catalogs in 1939 and many of them could be propagated on order.

One factor standing in the way of increased planting is the difficulty of propagating the trees. Young hickory stocks have a very large tap root, making the trees difficult to handle in the nursery. This can be surmounted by cutting the tap root about 18 inches underground at least a year before transplanting, thus forcing lateral roots to form. Well managed nurseries provide for this and such trees are much more likely to succeed than those transplanted from the wild.

PECAN. The pecan so extensively grown in the cotton belt and extending in its natural range into parts of Indiana and Illinois, has not been successful in the Northeast. This is not because of tenderness to winter cold but rather to the relatively short, cool growing seasons which do not mature the nuts.

There are a number of hybrid varieties which make good shade trees. Among these the "Burlington" is particularly attractive. It has been perfectly hardy at Ithaca, has good clean foliage and occasionally has matured a few nuts. Usually they have been frozen on the trees before maturing. Other hybrid sorts such as the "Gerardi," the "Des Moines," and the "Pleas" have attractive foliage and make good shade trees.

In favorable locations in southern Pennsylvania some of the northern varieties of pecans occasionally mature crops of nuts. Anyone planting these should use varieties which are of northern origin. Among these are the "Greenriver," "Major," and the "Posey."

CHESTNUT. In the past the chestnut has been by far the most valuable of the nut trees in the Northeast. The wild groves of this species have, however, been almost completely destroyed by the chestnut blight. This disease, coming into the New York area about 1900 has now covered practically the entire native range of the chestnut in North America. Sprouts from old stumps may live from year to year, their usual history being that they grow until they are about two or three inches through and 10 to 15 feet high. At this stage the bark forms fissures through which infection occurs with the result that the sprouts are killed and are replaced with suckers from the base. Sometimes these sprouts become large enough to bear a few nuts and there are constant rumors that the chestnut is coming back in the forests. This, however, does not seem to be the case as **there are no recorded instances of real immunity among trees of the native chestnut.** There has been a persistent attempt on the part of the federal government and some state forestry departments to introduce or develop other species

or hybrid varieties of the chestnut which would be resistant or immune to the blight. In this some success has been achieved. The Chinese chestnut (*Castanea mollissima*) and the Japanese chestnut (*C. crenata*) although not immune to the blight are highly resistant. Hybridizing these with each other and with the native American species to obtain blight resistant types is underway. There are at the present time a number of varieties that are distinctly promising. Among these are "Abundance," "Carr," "Hobson," and "Yankee." These are available from nurserymen and are well worth a trial. Newer sorts developed by the U.S.D.A. are the "Nanking," "Meiling," and "Kuling," are excellent for size and quality and are worth a trial. Some stock-scion incompatibility has appeared with Chinese chestnut varieties so that planting seedlings of good strains is being done. Many of the nuts are fully as sweet as the native chestnut, and considerably larger. The trees are not as hardy as the native chestnut and may be damaged by temperatures ranging around -25° F. There undoubtedly is great variation in hardiness in these varieties and they should be tested further.

FILBERT. Two species of native filbert occur in the Northeast. One of these is the beaked filbert (*Corylus cornuta*) and the other the American filbert (*C. americana*). These, however, are relatively inferior as compared with the European species, *C. avellana* and *C. maxima*, which together with their hybrids are the basis of the world's commercial industry. In New York tests have been made at the Geneva Experiment Station where a large number of varieties of European filberts have been grown. The limiting factor with most of these has been winter cold and late spring frosts. Temperatures of -20° F. have seriously injured many of the European varieties and late frosts frequently destroy the staminate catkins or pollen producing flowers and thus prevent a crop. The variety recommendations G. L. Slate based on experience at Geneva, New York are as follows:

"Cosford" and "Medium Long" are two of the hardiest varieties and with the exception of "Italian Red" are the most productive. Both are vigorous, upright trees. "Cosford" nuts are of medium size and thinnest shelled of all varieties tested. The nuts of "Medium Long" are slightly larger than those of "Cosford" and the shell is of medium thickness. The pellicle or fiber on the kernel is rather heavy.

"Italian Red" has thus far produced more nuts than any other variety tested, but at the Geneva Experiment Station in recent years the tree has not been as hardy as it appeared earlier and the variety is placed third on the list. The tree is vigorous and upright.

"Barcelona" in the earlier years of the test was the most productive variety, but recently the trees have experienced so much winter injury that the variety is recommended for limited trial only. The nuts are large, thick-shelled, and the kernels are covered with a heavy pellicle, but the tree is less vigorous than others, not productive, and is lacking in hardiness.

"Red Lambert" is as hardy as "Cosford" and "Medium Long" and produces

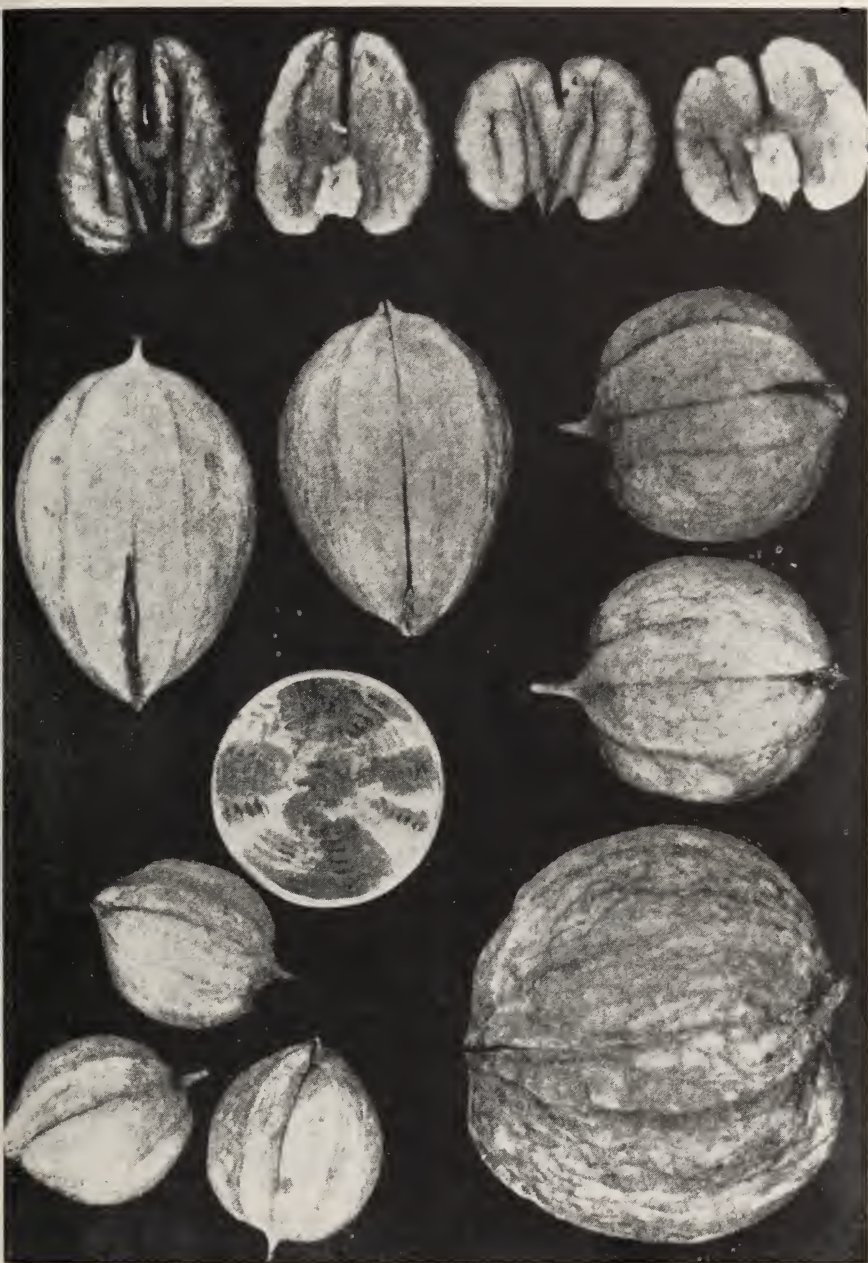


PLATE XI. Hickory nuts of various types. The large nut is the kingnut or shellbark hickory (*Carya laciniosa*). The nuts on the right are superior types with good cracking quality. The disk is slightly larger than a twenty-five cent piece.

a fine large nut, but the tree is unfortunately very unproductive and of value only as a pollinizer. Its spreading habit of growth makes it unsuitable for planting in a hedge with other varieties, most of which are of upright habit.

More recently a promising development in the filbert situation is the hybridization of American with European varieties. The varieties "Rush" from Pennsylvania and "Winkler" from Iowa of the American species are the varieties most used. "Rush" is a tall growing shrub and has borne well at Ithaca. "Winkler" is hardier, more productive and bears larger nuts, but makes a low growing shrub. Of the hybrid varieties the "Bixby" and "Buchanan" are now regarded as being the most promising because of their size and other merit of the nuts and hardiness of plant. Many other seedlings are being tested and seem promising.

Cultural Practices

It is not the purpose of this bulletin to give details as to the propagation of nut trees. In general the same principles are involved with this crop as with other fruit trees but the material is somewhat more difficult to manipulate and wholly efficient methods of budding or grafting have not been developed. It should be emphasized here, however, that in common with other fruit species, grafted trees are very much superior to seedlings. Nut varieties might very well be compared to apple varieties in this regard. Anyone who is familiar with the small, hard natural apple fruit which is found in the pastures of New England and knows of its bitter, astringent flavor can appreciate the difference between these and the better named grafted varieties such as the "Baldwin" and "McIntosh." The same differences exist with the nut trees also. The great majority of seedling nut trees have nuts that are so difficult to shell that there is little incentive to grow them. The named and grafted varieties, however, may be said to be as superior to the ordinary run of seedlings as the grafted apples are superior to natural fruit. Better varieties of nut trees should bear nuts of good size which have a high proportion of good quality kernels which are easily shelled out. It is not difficult to imagine what a difference it would make if the many millions of wild trees bore nuts of as good quality as the selected and named sorts.

Obtaining trees of desirable varieties may be something of a problem. Many varieties are already in the trade and are being propagated by nut tree specialists. It is also possible to have particular varieties propagated to order. It must be realized, however, that nut trees are much more difficult to produce in the nursery than are apples or pears and in justice to himself, the nurseryman is compelled to charge more for the nut trees than for other fruit trees.

For one really interested in the growing of nut trees a good practice is to top work established stocks by grafting. It is not too difficult to learn the technique and in many localities there are nurserymen and plantsmen who will make grafts as desired.

To grow seedling stocks it is necessary to stratify the seeds before planting.

This should be done in the early fall before the nuts have been allowed to become very dry. The process of stratification involves keeping the nuts at temperatures slightly above freezing. Best results are obtained by keeping nuts buried in moist peat moss at a constant temperature of about 35-40° F. Such conditions may be found in cold storage houses. For the grower, successful stratification can be attained by exposing the nuts to winter temperatures. This is done by burying the nuts in sand and leaving them in an exposed place which should be well drained. Protection with wire netting is necessary to keep rodents from destroying the seeds. If danger from theft by rodents is not likely and the soil is well drained, the seed nuts may be planted in the nursery row in the fall or they may be planted in their permanent location in the fall or the stratified nuts planted out in the spring.

Those desiring only a few nut trees of named varieties may best purchase them from nurserymen who are specializing in nut tree propagation. There are a number of these in the Northeast and Middle West. A list of nurserymen can be obtained from the Northern Nut Growers' Association. If nut growing is to be carried on as a hobby and a considerable number of trees are to be involved, a good practice is to raise seedlings and get them established in their permanent location and then graft the most vigorous individual trees to well-chosen varieties. Scions may be obtained from trees locally or from nurserymen who furnish scions.

Soils suitable for nut trees are the same as those required for almost any other fruit crop. The first requirement is that they shall be deep and well drained. Thin topsoil overlying impervious subsoils which remain soggy will not grow good trees. Often rocky soils are very good because they usually are well drained unless the underlying rock is impervious. The most favorable soils are friable loams of good organic content and good moisture holding capacity. Fertility can be easily supplied to poor soils which are suitable in texture and drainage by the use of leguminous cover crops, and by application of barnyard manure or complete commercial fertilizers. It is a mistake to plant nut trees on heavy, worn-out soils that are not good agricultural lands. On the other hand they may very well be planted in rocky lands incapable of cultivation provided other conditions are favorable.

The planting of nut trees does not differ essentially from planting trees of other kinds except possibly that most nut trees have few fibrous roots and hence must be planted with unusual care. Hickories are difficult to transplant because of the scarcity of lateral roots and the slow rate at which new roots are formed. If the taproot has not been cut a year previous to digging or the tree transplanted in the nursery row once or twice, there are likely to be practically no fibrous roots and the chances of survival of the tree are slight. If seedling trees are to be brought in from the woods, it is of great advantage to cut off the taproot about 18 inches below the surface of the ground a year before transplanting and thus stimulate the formation of the lateral roots near the surface. There is an advan-

tage in buying trees from nurserymen skilled in the propagation of nut trees because attention is given by them to developing a good root system.

While the trees are out of the ground, care should be taken not to allow the roots to become dry before planting. Keeping them covered with wet burlap or puddling them in a moist clay is highly important. Some trees can be bought balled and burlapped but this is expensive and should be unnecessary. The hole should be dug large enough so that all of the roots can be accommodated readily and the topsoil should be worked in carefully around them. One of the most important practices is to firm the soil about the roots with a tamping stick of some sort. At the time of planting the soil should be moist but not wet enough to puddle or cake when firmed with the tamper. After planting, the trees should be well watered and weeds kept down about the trees either by cultivation or by mulching. This is particularly important until the trees become well established. At the time of planting the tops of practically all nut trees should be cut back to about one-third or one-half of the wood present in the nursery, making sure that at least several good buds remain. This is important because even with carefully dug trees a large proportion of the root system is destroyed or damaged in digging and the top must be cut proportionally. After planting, if the season is dry, the trees should be watered during dry periods of at least the first season or longer if necessary until they become established.

On soils that are low in organic matter a good practice is to work in granulated peat moss with the soil about the roots. Care should be used that the peat is well soaked with water either before or after the planting, otherwise it will be of no benefit. Covering the trees with wax has been recommended by some authorities but under conditions of hot sun this practice has proved injurious and is not recommended.

After the nut trees become established not much care is needed. Pruning is of less importance than with most fruit trees. With walnuts and hickories it is sometimes necessary to correct faulty crotch structure and space the limbs about the trunk. The most common fault is the development of two leaders which are about the same size. If this occurs one should be removed or at least pruned severely to dwarf it with relation to the other. Hickories and walnuts should be so trained that central leaders, or modified central leaders will develop. For best yields filberts should be trained as standard trees without suckers at the base. In removing a sucker, the soil is dug away from the base of the tree exposing the base of the sucker where it joins the root and the sucker removed with a sharp saw, cutting close to the main root.

Fertilizers

Nut trees respond to fertilization and good soil management much as do other fruit trees although many wild trees apparently do well in competition with other vegetation. Outstanding growth or yield is usually associated with an unusually

favorable situation as to soil fertility, moisture supply or other soil conditions. It is a mistake to think that nut trees will survive under adverse conditions. Neglect, especially before the trees are well established, will often result in the loss of the trees. Nut trees do particularly well under cultivation which keeps weeds and other growth away from the soil over the roots. This, however, is rarely practical with nut trees in the fence row or around the home. The benefits of cultivation can be largely secured by mulching the area under the trees so that the weeds are kept under control. Any plant material such as old hay or straw or garden refuse is suitable for mulching purposes.

On soils low in fertility nut trees will respond to applications of nitrogen. Either sodium nitrate or ammonium sulfate may be used, the former probably being preferable with the walnuts which are adapted to neutral or alkaline soils. Trees growing in sod may be fertilized at the rate of $\frac{1}{4}$ pound of ammonium sulfate or sodium nitrate for each inch of the diameter of the trunk until they have attained a diameter of about 6 inches when about $\frac{1}{2}$ pound may be used for each inch in diameter up to the maximum of 15 to 20 pounds per tree. With large trees that are well established, much more fertilizer should be added. The above is of course only an approximation. The actual needs of the tree will depend upon the natural fertility of the soil and other conditions. The trees should be observed carefully to avoid either excessive stimulation of growth, which would make the trees liable to winter injury, or the other extreme of an under-vegetative condition as indicated by yellow, sparse foliage and poor yields. In general trees suffer much more from the lack of fertility than from too much. If trees are to yield regular crops they must be fertilized regularly and adequately. There is some evidence to show that some of the minor fertilizer elements, particularly zinc, are deficient in some of the soils of the Northeast.

Zinc deficiency shows up as weak yellowish growth late in the season. The leaves are small with the edges curled upward. Application of zinc sulfate is usually an effective control.

Insect and Disease Troubles

Insect and disease troubles are about as common for nut trees as for any other shade trees. The problem is complicated by the fact that most home owners can not have their trees sprayed. There are a number of caterpillars which destroy the foliage. Among them, most commonly encountered is the walnut caterpillar which appears about mid-summer and may seriously defoliate the trees one or more times in a single season. These may be controlled with arsenate of lead. Where the trees are not sprayed it is often possible to destroy the worms by collecting them when they gather on the trunk in a mass to shed their skins. These caterpillars and others on hickories can often be destroyed before they attain large size on small trees by picking off the leaves upon which they are feeding. They usually feed in groups close together. Hickories and chestnuts sometimes

have the nuts destroyed by weevils. The control here is to destroy all nuts which drop to the ground before the weevils emerge. This may be fairly easy if the trees are in the lawn but difficult if the ground is rough. The Persian walnut is attacked by the codling moth, which is similar to that which damages apples. Spraying with arsenate in mid-summer when the moths appear is an effective control.

Diseases are usually not troublesome with nut trees although under some conditions they may be. There is a blight which sometimes attacks the filberts, appearing as dead and brown shoots. If affected parts are cut out promptly and burned, the trouble is usually easy to control. Some varieties of walnut, particularly the "Thomas," become infected with a perennial canker. This is relatively less damaging on trees that are growing rapidly so that good cultural practice is a means of control. Of course the chestnut blight has been the most devastating disease of nut trees which has practically wiped out the chestnut in its natural range. Methods of controlling this disease in the American and European chestnuts have not been developed. Of the blight resistant Chinese and Japanese species, it is worthwhile to cut out blighted limbs as they occur and to cut away bark cankers on the trunk. The cut surfaces should be painted with some good antiseptic solution.

Nut trees, particularly the hickories and walnuts ordinarily bear only in alternate years. This is a natural tendency which is to be observed also with other fruit trees. There is apparently little that can be done to control it although it may be lessened somewhat by an adequate fertilizer and soil management program. Thinning the nuts while still green should also be of help but is not practiced. What happens is that during the bearing year the crop is such a heavy drain on the food manufactured in the leaves or possibly other substances, that there is not enough for bud formation for the following year. Different varieties vary in this respect. The chestnut and the filbert do not alternate as seriously as the walnut and the hickory.

Cross Pollination

Most kinds of nuts require cross pollination. From a practical standpoint this means that at least two varieties of each species which flower simultaneously should grow together. With kinds that are frequently planted this may offer no problem to the individual home owner as neighbors may have trees which will be a source of pollen. With the filbert and chestnut, however, two varieties should always be planted together. To a somewhat lesser degree this is the case with the Persian walnut and the hickories. The pollination requirements of black walnut are not well understood but it is highly probable that cross pollination is necessary for this species also. In small areas where several trees cannot be planted, a part of the tree may be top worked to another variety. The pollen of the walnut, filbert and hickory is wind borne and may be carried over a consider-

able distance. It is impossible to state with accuracy how close together it is necessary for trees to be planted for cross-pollination. Anywhere within the radius of 100 feet should be satisfactory.

Harvesting Nuts

Nuts should be allowed to become fully mature on the trees and preferably to fall naturally. Mild shaking is sometimes practiced to bring down the last of the crop but clubbing the branches is seldom justified. Nuts should be picked up as soon as they fall. This is particularly necessary with the Persian walnut which discolors if allowed to lie on the ground and with the black walnut, the husks of which may disintegrate into a brown mass if not picked up within a few days after falling. Black walnuts should be shucked soon after harvesting to prevent discoloration of the kernels. Small quantities of black walnuts are beaten or tramped from the husks. With larger quantities the old fashioned corn sheller may be adjusted to remove the husks satisfactorily. Black walnuts that are washed immediately after removing the husks will remain an attractive brown color instead of turning black. Nuts of all species should be allowed to dry after the husks are removed. Small quantities can be spread out on the floor of a well ventilated shed or attic. With larger quantities some sort of racks with screen bottoms can be devised. The drying room must have a free circulation of air.

One of the commonest difficulties experienced with nut trees in the North is that the kernels fail to fill. There are a number of causes which contribute to this condition. Probably the most frequent, particularly with the hickories and walnuts, is too short a growing season or too little summer heat. Under these conditions the leaves are frozen from the trees while the nuts are still immature and no further development of the kernels take place. The problem may be better understood when it is realized that in the development of most kinds of nuts, the growth of hull and shell to full size takes place early in the season. During the latter part of the season the kernels are developed from the carbohydrates which are manufactured by the leaves. It is thus obvious that any condition which cuts down the effectiveness or destroys the leaf surface will effect the filling of the nuts. This may be due to loss of leaves by insects or diseases or to interference with their effective function by drought or inadequate nitrate supply. Another condition is found in trees in an over-vegetative condition where the growing shoots use up the food materials which otherwise might go into the kernels. This is apt to be found with young rapidly growing trees or trees kept growing with frequent irrigation. There is little that can be done to control the failure to fill except to grow varieties which are adapted to the locality as to length of growing season and protecting the leaf surface from pests and disease troubles. Supplying water at time of drouth and a good fertilizer program are also helpful.

Summary

In the foregoing pages an attempt has been made to outline the requirements

for growing nut trees in the Northeastern states. There is nothing in the situation which should encourage anyone to try to establish commercial plantings in this area unless possibly with some of the newer chestnuts and some varieties of black walnuts. On the other hand it should be emphasized that there is real value in planting grafted trees throughout the Northeast both for shade trees and for the nuts which may be produced for home use. The fact that at the present time we do not know which varieties will succeed best over a period of years only adds to the interest of the problem. Enough is known to assure the growing of good shade trees and certainly in some measure improved nut crops will result. Nut kernels are a product that is without equal for food value and palatability, and producing a supply for home use merits the attention of all who have land at their disposal.

All home owners in the villages and on the farms may be encouraged to plant nut trees for shade with the realization that even though the large crops of superior nuts may not result, the testing of the varieties will be a real service in developing our knowledge of nut growing in the Northeast.

It should also be emphasized that at the present time there are undoubtedly many superior varieties of nut trees that are adapted to growing in various localities but which have not been propagated and tested. They are standing as wild trees in the fields and along the fence rows on the farms or in dooryards. Trees which bear nuts of outstanding value and which bear crops fairly regularly should be brought to the attention of some agency which would be capable of judging the relative merit of the variety and seeing to it that the tree is propagated and tested further. The Northern Nut Growers' Association, J. C. McDaniel, secretary, Dept. Horticulture, University of Illinois, Urbana, Illinois, has been organized to do this sort of thing. Some of the state experiment stations and the United States Department of Agriculture are also equipped to test the merit of new varieties. Anyone knowing of superior trees will do a real service by calling them to the attention of one of these agencies.

L. H. MacDaniels

Dept. of Floriculture and Ornamental Horticulture
Cornell University



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

APRIL 18, 1952

NUMBER 5

THE FLOWER COLORS OF ONE HUNDRED HARDY AZALEAS

THERE are literally hundreds of azaleas being grown in the United States today; many are hardy only in the warmer parts of the country. However, there are a large number being grown in the Arnold Arboretum, and it might be of interest to note the color of one hundred of these. Our records are not complete concerning the flower colors of all the varieties we are growing, but each one in the following list has been grown in the Arboretum and its flower color has been compared with the color chart of the Royal Horticultural Society.

It is perfectly evident to anyone who has studied flowering plants that the color of the flowers varies from day to day, and possibly even from year to year. It is impossible to record in words or numbers the exact colors in some of the varieties which may sport several beautiful colors in one flower. Rather, it has been the practice here to record the major color for any such list as is offered here, refraining from minute descriptions such as that in our records for Azalea "Prince Henri de Pay Bas," reading as follows: "Flower: 2 $\frac{1}{4}$ " in diameter, 614/1 on edge of upper petal with 9 at throat; other petals 20/1 with white streak in center of outer tip." Instead, this is listed as merely 20/1 (geranium lake), this being the predominating color of the flower.

As previously noted in ARNOLDIA (Vol. 7: 41-52, 1947) the Royal Horticultural Colour Chart is still America's best means of properly identifying flower colors. The means by which colors and hues are recorded as numbers as well as names, has many advantages already discussed in the earlier issue of ARNOLDIA. Various movements have been started in the United States to produce "better" color charts, but as yet, none have been published. Consequently, the following list is offered as a rough approximation of the coloring of these azaleas as they have bloomed in the Arnold Arboretum during the past years, measured by means of comparisons with the Royal Horticultural Colour Chart.

Azalea Flower Colors

(All flowers are single unless otherwise noted)

	<i>Size</i>	<i>Bud</i>	<i>HCC' fl</i>	
albrechti	2''	25	25/2	Rose Bengal
"Alphonse Lavallee"	3 $\frac{1}{4}$ ''	—	620/1	Porcelain Rose
"Anthony Koster"	2 $\frac{1}{2}$ ''	12/2	605/2	Chrome Yellow
"Apricot"	2''	—	21/3	Carmine
"Atlanta"	2''	—	630/1	Mallow Purple
"Aurore de Royghem"	2 $\frac{1}{2}$ ''	—	427	Rose Pink
"Beethoven"	2 $\frac{3}{4}$ ''	—	31/1	Orchid Purple
"Betty"	1 $\frac{7}{8}$ ''	—	623/2	Neyron Rose
"Big Joe"	2''	—	630/1	Mallow Purple
"Bijou des Amateurs"	—	0619	523	Dawn Pink
"Bijou de Gandbrugge" (dbl)	1 $\frac{3}{4}$ ''	—	17/2	Mandarin Red
"Bouquet de Flore"	2''	—	20/2	Geranium Lake
"Briarcliffe"	1 $\frac{1}{4}$ ''	—	625/2	Spinel Pink
"Bryon" (double)	2 $\frac{1}{4}$ ''	white, hose in hose		White
calendulaceum croceum	2''	—	604/1	Straw Yellow
"Cardinalis"	1 $\frac{1}{4}$ ''	—	625/1	Spinel Pink
"Carmen"	2 $\frac{1}{2}$ ''	022	22/1	Crimson
"Carmine"	2 $\frac{1}{2}$ ''	—	623/1	Neyron Rose
"Caroline Gable"	1 $\frac{5}{8}$ ''	23/1	623	Neyron Rose
"Charlemagne"	2''	13/1	11/2 and 607/2	Marigold Orange, Maize Yellow
"Cherokee"	1 $\frac{1}{2}$ ''	—	820/2	Blood Red
"Chinook"	2''	—	620	Porcelain Rose
"Cleopatra"	2 $\frac{1}{2}$ ''	—	623/1	Neyron Rose
"Coccinea Speciosa"	—	13	13/1	Saturn Red
"Compte de Flandre"	2 $\frac{1}{8}$ ''	—	21/1	Carmine
"Compte de Papadopoli"	3''	016/1	620/1	Porcelain Rose
"Compte de Quincy"	2 $\frac{1}{2}$ ''	605/1	605/2	Chrome Yellow
"Consul Ceresole"	3 $\frac{1}{2}$ ''	19/1	620/1	Porcelain Rose
"Coquette"	3''	620	623	Neyron Rose
cumberlandense	1 $\frac{1}{2}$ ''	—	15/1	Fire Red
"Cymodoce"	2 $\frac{1}{2}$ ''	619/1	523	Dawn Pink
"Daviesi"	2 $\frac{1}{4}$ ''	604/1	White	White
"Dexter's Pink"	1 $\frac{1}{2}$ ''	—	625/2	Spinel Pink
"Dr. Chas. Bauman"	1 $\frac{3}{4}$ ''	—	14/2	Nasturtium Red
"Early Dawn"	1 $\frac{1}{2}$ ''	—	28/2	Fuchsia Purple
"Elizabeth Gable"	2 $\frac{1}{8}$ ''	622	622	Camellia Rose
"Fanny"	2 $\frac{3}{8}$ ''	—	625/1	Spinel Pink

	<i>Size</i>	<i>Bud</i>	<i>HCC fl</i>	
"Fedora"	2''	—	625/1	Spinel Pink
"Flamboyant"	2''	018	016/1, 607/1, 601/2	Brick Red Maize Yellow Primrose Yellow
"Flora"	1½''	—	619/1	Coral Pink
"Frere Orban"	2½''	—	605/3	Chrome Yellow
"Furst Camille Von Rohan"	2½''	605/2	White	White
"Gloria Mundi"	2½''	—	13/1	Saturn Red
"Glory of Dawn"	2''	—	625/2	Spinel Pink
"Graf Von Meran" (double)	—	623/1	623/2	Neyron Rose
"Heureuse Surprise"	1¾''	—	527/2	Rhodamine Pink
"Hortulanus Witte"	2''	612	9/2	Tangerine Orange
"Hugo Koster"	2¾''	016/1	16/2	Poppy Red
"Ignaea Nova"	2½''	821/3	719/3	Signal Red
"Il Tasso" (double)	2¼''	—	19/2	Scarlet
"Irene Koster"	2½''	616/1	523/2	Dawn Pink
"Iriquois"	1¾''	—	19/2	Scarlet
"Joh. S. Bach"	2½''	—	28/2	Fuchsia Purple
"Josephine Klinger"	1¾''	—	619	Coral Pink
"La Lumiere"	1½''	021	021	Claret Rose
"La Priemere" (double)	1''	527	625/3	Spinel Pink
"Louise"	1¼''	—	23/1	Rose Madder
"Louise Gable" (double)	1¾''	—	621/1	Empire Rose
"Marion Merriam"	2½''	—	9 upper corolla, 605, lower	Tangerine Orange Chrome Yellow
"Mary Dalton" (double)	1¾''	20/1	19/2	Scarlet
"Mauve Queen"	2¼''	—	630/2	Mallow Purple
"Mello-Glo"	1''	—	26/2	Solferino Purple
"Milton" (double)	2¼''	—	White	White
"Minerva"	2¼''	—	622/3	Camellia Rose
"Minestre Thorbecke"	3¼''	016/1	616	Shrimp Red
"Miriam"	1¾''	—	623/1	Neyron Rose
"Mme. Gustave Guillemot"	2¼''	822/3	22/1	Crimson
"Mossieanum"	—	—	627/1	Fuchsine Pink
"Narcissiflora" (double)	1¾''	605	605/1	Chrome Yellow
nudiflorum	1½''	—	625/3	Spinel Pink
obtusum amoenum	1⅞''	0621	523/1	Dawn Pink
obtusum arnoldianum	1¾''	—	627	Fuchsine Pink
obtusum japonicum	¾''	—	630/1	Mallow Purple
obtusum kaempferi	2½''	—	620	Porcelain Rose
"Old Faithful"	2¾''	—	632/2	Phlox Purple

	<i>Size</i>	<i>Bud</i>	<i>HCC fl</i>	
"Othello"	1''	—	20/1	Geranium Lake
"Pallas"	1 $\frac{3}{4}$ ''	018	018/1	Jasper Red
"Phidias" (double)	1 $\frac{3}{4}$ ''	618	602/3	Mimosa Yellow
"Phoebe" (double)	2''	5/2	606/2	Chinese Yellow
"Polaris" (double)	1 $\frac{3}{4}$ ''	—	White	White
"Praxiteles" (double)	1 $\frac{3}{4}$ ''	7/2	604/2	Straw Yellow
"Prince Henri de Pay Bas"	2 $\frac{1}{4}$ ''	020/1	20/1	Geranium Lake
"Pucella"	1 $\frac{3}{4}$ ''	—	623/2	Neyron Rose
"Purple King"	1 $\frac{5}{8}$ ''	—	027/1	Magenta Rose
"Raphael de Smet" (double)	—	620	420/2	Venetian Pink
"Rembrandt"	1 $\frac{1}{2}$ ''	0022	022/1	Rose Opal
"Roi des Feux"	2''	821/1	719/3	Signal Red
roseum	2''	623	623/1	Neyron Rose
"Sang de Gentbrugge"	1 $\frac{3}{4}$ ''	00823/2	719/3	Signal Red
schlippenbachi	3''	—	427/1	Rose Pink
"Sibeliu"	2''	—	018/1	Jasper Red
"Souvenir de Pres. Carnot" (dbl)	1 $\frac{1}{2}$ ''	—	8/2	Cadmium Orange
"Springtime"	2''	—	24/2	Tyrian Rose
"Unique"	2''	—	9/1	Tangerine Orange
vaisyi	2 $\frac{1}{4}$ ''	22/2	24/3	Tyrian Rose
viscosepalum	1 $\frac{3}{4}$ ''	4/2	White with 6/1	Indian Yellow
"William III"	2 $\frac{1}{4}$ ''	018	14/2	Nasturtium Red
yedoense (double)	2''	—	30/2	Cyclamen Purple
yedoense poukhanense	2''	—	632/2	Phlox Purple
"Zampa"	2 $\frac{1}{4}$ ''	022	625/2	Spinel Pink

DONALD WYMAN

Field Class

Informal Field Classes to study the hundreds of ornamental trees and shrubs will be held in the Arboretum again this year during the Saturday mornings throughout May. Meetings will start at 10 A.M. at the Jamaica Plain gate in front of the Administration Building. In case of rain the meetings will be indoors. Registration is in advance (\$1.00 fee) by mail: "Friends of the Arboretum" without charge.

ARNOLDIA



Gray Herbarium
Harvard University
May 2, 1952

A continuation of the BULLETIN OF POPULAR INFORMATION of the Arnold Arboretum, Harvard University

VOLUME 12

MAY 2, 1952

NUMBER 6

SPRING COMES TO THE ARNOLD ARBORETUM

THIS past winter has been a mild one; temperatures have not gone much below zero on any occasion and in the late winter, at least, there was plenty of snow cover. The bad weather in March was followed in mid-April by many bright sunny days with high temperatures which brought the magnolias and the single flowered Japanese cherries into full bloom by April 18. In fact the early flowering magnolias have never looked as beautiful as they did during mid-April, none of the flower buds showing any injury at all.

One magnolia in particular this year has again been very beautiful and this is a cross made by one of Dr. Sax's students in 1939 — *M. stellata* × *kobus*. This is now a tree 18 feet tall and at least 12 feet in branch spread, covered with beautiful white flowers, very similar to those of *M. stellata* and with the fragrance of *M. stellata*, but there the similarity ceases for it is growing as a vigorous tree with a single trunk. The flowers have nearly as many petals as those of *M. stellata*, but the flower petals are considerably wider. (See Plate XII.) E. H. Wilson used to point out that *M. kobus* did not bloom for fifteen years, but this vigorous hybrid bloomed within five years from seed. Professor Rehder termed all crosses between these two species *M. loebneri*, and this particular clone has been named the "Merrill" magnolia in honor of Dr. E. D. Merrill, former Director of the Arnold Arboretum. It can be considered an excellent addition to our early flowering magnolias, combining the vigor and habit of *M. kobus*, and the beautiful flowers of the slower growing and smaller *M. stellata*.

Usually at this time of year, everyone wonders whether the spring is "early" or "late" and one of the means we have of measuring, is to record the definite dates at which certain plants bloom or come into leaf. A certain weeping willow in front of the Administration Building has a habit, as do all weeping willows, of turning a pale green almost overnight in the spring as its small leaf buds be-

gin to open. The dates on which this has occurred during the past years are as follows :

1940	May 1
1941	April 15
1942	April 6
1943	April 28
1944	May 1
1945	March 27
1946	March 27
1947	April 14
1948	April 5
1949	April 4
1950	April 28
1951	April 8
1952	April 19

From this it would appear that the season is about normal. We can look forward to profuse bloom among the azaleas and the crab apples by early May and the lilacs should be in the best of condition by May 20, unless we have much unfavorable weather between now and then.

In general, little winter injury has been noticed. A few exceptions have been that the flower buds of *Rhododendron dauricum* were killed, but on the other hand the flower buds of *Abeliophyllum distichum* were not injured and this shrub has bloomed unusually well. It should be mentioned in this connection, that severe damage was noted on small azalea plants last fall *before* November 1. Several hundred azalea plants under a foot high were grown in one of the saran cloth houses at Weston. The summer drought was followed by unusually heavy rains in the fall and there were at least three times, prior to November 1, when night temperatures went considerably below freezing. It was noted then that the bark on these small plants separated from the twigs and now, of course, the tops of these plants are completely dead. Several cases of winter injury to broad-leaved rhododendrons have also been called to our attention, but the specific reasons for this injury are unfortunately in doubt.

An extensive collection of flowering crab apples has been planted on Peters Hill. Included in this collection are some of the more valuable Asiatic species, new varieties, which have been introduced by the commercial nurserymen, and the new hybrids which have been developed at the Arboretum during the past fifteen years. This new planting, together with the older introductions of species from all parts of the world, should eventually provide the most complete collection of ornamental apples in the world.

DONALD WYMAN

Note: Lewis Lipp has been appointed propagator at the Arnold Arboretum to replace Richard Fillmore who resigned this spring to accept a more lucrative position with a commercial nursery. Roger Coggeshall remains as assistant propagator.



PLATE XII

Upper fig. *Magnolia loebneri* "Merrill."

Lower fig. Top row, left to right: *M. kobus*, *M. stellata*, *M. loebneri* "Merrill."

Bottom row, left to right: *M. salicifolia*, *M. denudata*, *M. proctoriana*.

A NOTE ON LIGUSTRUM IBOLIUM

In Inventory #46, 1916, of the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, there is described the origin of a hybrid privet, *Ligustrum ovalifolium* \times *L. obtusifolium regelianum*, now known as *L. ibolium* Coe, the Ibolium privet. At that time, cuttings of several selections from the cross were presented by the Elm City Nursery Company, New Haven, Connecticut, accompanied by the description summarized here. In the fall of 1900, a plant of *L. ovalifolium* growing in their nursery among several plants of *L. obtusifolium regelianum* bore an especially heavy crop of fruit. Since fruiting of the California privet was uncommon in the locality, the inference was that a natural cross had occurred. When the seedlings were raised, they showed every indication of hybridity, varying from upright and vigorous to prostrate and dwarf, from deciduous to more or less evergreen and producing flowers from terminal or lateral branches.

The upright selection of *L. ibolium* is well known in the nursery trade, valued for its handsome habit similar to the California privet, but approaching the less attractive *L. obtusifolium* in hardiness. In current descriptions of *L. ibolium*, one finds no mention of the existence of dwarf forms, but two of the dwarf selections from the original introduction are still being grown at the U.S. Plant Introduction Garden, Glenn Dale, Maryland. The plants are from 1928 propagations and have attained scarcely 18 inches in height, with dense, glossy, somewhat persistent foliage that remains reddish-green at temperatures down to 0° F., and has wavy leaf margins. The two selections differ mainly from each other in the size of the leaves and one plant is more prostrate than the other. Eventually one will be eliminated but not until the relative hardiness and adaptability factors have been studied. The plants have now been moved to a test nursery where they show every indication of becoming desirable additions to the rather limited group of hardy, dwarf plants.

As there is always a need for plants that will make good low hedges or compact borders, a privet with such a habit and, in addition, the hardiness attributed to *L. ibolium* should arouse considerable interest among nurserymen. At the present time, the selections are carried under a garden number until they can be propagated for distribution and wider testing.

JOHN L. CREECH
Division of Plant Exploration and
Introduction
Bureau of Plant Industry, Soils and
Agricultural Engineering
Beltsville, Maryland

ARNOLDIA



Gray Herbarium
Harvard University

OCT 16 1952

5

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

OCTOBER 10, 1952

NUMBER 7

SOME WINTER-KILLING OF CERTAIN SHRUBS,
AS A RESULT OF THE WINTER OF 1951-52

LAST winter (1951-52) was not what might be termed a "hard" winter, especially at the Case Estates of the Arnold Arboretum in Weston, Mass. In one of the fields on this 150 acre plot there are a number of miscellaneous ornamental shrubs which were planted three years ago in rows ten feet by ten feet and cultivated mechanically, the idea being that these plants are a reserve plantation for the Arnold Arboretum, where a few good varieties, and many mediocre ones are merely grown to augment the collections in the Arboretum at Jamaica Plain. It is impossible, for lack of space, to grow all the species and varieties that we would like to in Jamaica Plain, but this additional planting is not too space-consuming, is easily cared for and is accessible to anyone who is interested in these plants.

Over 500 species and varieties have been growing in one of these fields since 1946. After this past winter, it was noted that some plants were killed to the ground, others partially, and still other species and varieties were apparently winter hardy. Since all the plants are growing together, since the climate and soil are uniform, since no plants received any more attention in the way of water or fertilizer than any other, it is reasonable to deduce that, if a variation in winter killing is shown here it is undoubtedly caused by variation in individual plant hardiness.

Many factors must be included in determining the hardiness of plants such as winter cold, rainfall, snow cover, early and late freezes, etc. Plants vary considerably with their specific requirements, and no one of these factors should be taken as the only one involved in winter hardiness. However, in determining winter loss, temperatures are certainly the easiest records to look to, when rainfall has been normal, and in this study only the temperature factor is given.

The coldest days for November 1951 to March 1952 were:

November	7° F	January	-1°, -4° F
December	-2°, -4°, -5° F	February	7° F
March	10° F		

There were only five days throughout the winter when the minimum temperatures went below 0° F. We have learned to expect little winter injury in the Arnold Arboretum unless winter temperatures go considerably below this point.

It will be of interest to study the following lists. Only those varieties (and species) are reported that are being grown here together in this one field. In general, especially in the Arboretum itself, there was not too much winter injury last year, where the winter temperatures are usually several degrees higher than those at the Case Estates, twelve miles away.

The Percentage of winter killing of vegetative shoots of certain woody plants grown at the Case Estates of the Arnold Arboretum as a result of the winter 1951-52

Note: All plants have been growing here together in a cultivated field for five years and were between 3 feet and 8 feet in height.

Acanthopanax ternatus 10%	*Deutzia mollis
* " trifoliatum	" ningpoensis 50%
*Berberis actinacantha	" purpurascens 50%
* " aggregata barbarosa	* " reflexa
* " " recurvata	" rosea 50%
" consimilis 50%	" " campanulata 75%
* " "	* " " eximea
" deltsiana 50%	* " " grandiflora
" laxiflora langeana 50%	* " " multiflora
" parvifolia 50%	* " scabra "Eminens"
* " poireti weichangensis	* " " macrothyrsa
* " polyantha	* " " mirabilis
" silva-taroucana 50%	* " " suspensa
" suberecta 50%	* " " watereri 10%
*Buddleia nivea	" schneideriana 10%
* " yunnanensis	* " " laxiflora
* " stenostachya	* " sieboldiana
Deutzia carnea 75%	" staminea 10%
* " " lactea	* " villmorinae
* " " stellata	* " "Avalanche"
* " chuni	* " "Boule Rose"
" discolor 10%	" "Contraste" 75%
* " " major	" "John Richardson" 10%
" hypoglauca 50%	Ligustrum obtusifolium 20%
" hypoleuca 50%	" quihoui 50%
" lemoinei "Boule de Neige"	" sinense 50%
10%	" vulgare "Lodense" 75%
* " longifolia elegans	*Philadelphus burkwoodi
* " " faureri	" delavayi 30%
* " magnifica longipetala	" falconeri 10%

Philadelphus lemoinei "Enchantment" 30%
Philadelphus sericanthus rehderianus 10%
Philadelphus "Amalthee" 50%
 " " "Banniere" 75%
 " " "Boule d'Argent" 50%
 " " "Dame Blanche" 50%
 " " "Enchantment" 25%
 " " "Favorite" 25%
 " " "Manteau de Her-
 mine" 10%
Philadelphus "Monster" 30%
 " " "Patricia" 10%
 " " "Voie Lactee" 90%
Elea polyadenia 10%
bes diacanthum 50%
 " " "ussuriense" 50%
 " " "Quebec" 75%
Hamnus dumetorum 50%
Barbaria assurgens 10%
 " " "sorbifolia" 75%
Spiraea alba 10%
 " " "albiflora" 10%
 " " "billiardi" 10%
 " " "blanda" 50%
 " " "brachybotrys" 50%

Spiraea cantoniensis 50%
 " " "macrothrysa" 50%
 " " "margaritae" 10%
 " " "pachystachya" 25%
 " " "pyramidata" 50%
 " " "revirescens" 75%
 " " "rosthorni" 50%
 " " "schimabecke" 50%
 " " "trilobata" 50%
Weigela hortensis 50%
 " " "japonica" 50%
 " " "japonica var. (variegated)" 10%
 " " "Stelzneri" 50%
 " " "Vanhouttei" 20%
 " " "Andre Thouin" 25%
 " " "Chamaelon" 75%
 " " "Congo" 50%
 * " " "Dame Blanche"
 * " " "Descartes"
 " " "Groenwegeni" 60%
 " " "Hendersoni" 75%
 " " "Ideal" 20%
 " " "Le Printemps" 10%
 " " "Madame Lemoine" 20%
 " " "Majesteaux" 50%
 " " "Richesse" 25%

Plants killed to the ground

Weston permanent nursery plants not injured — Aug. 6, 1952

Anthropanax divaricatus
 " " "henryi"
 " " "nana"
 " " "leucorrhizus"
 " " "senticosus"
 " " "sessiliflorus"
 " " "simoni"
Berberis—some 59 species and varieties, mostly very rare, but including:
Berberis aggregata

Berberis amurensis
 " " "aristata"
 " " "bretschneideri"
 " " "canadensis"
 " " "circumserrata"
 " " "dictyophylla"
 " " "gilgiana"
 " " "vernae"
 " " "vulgaris"
Deutzia glabrata
 " " "monbeigi"

Deutzia parviflora	Spiraea arguta
“ scabra macrocephala	“ blumei
Ligustrum acuminatum	“ cana X thunbergi
“ acutissimum	“ canescens myrtifolia
“ amurensis	“ cantoniensis lanceata
“ insulare	“ chainaedyfolia
“ sinensis stauntoni	“ “ ulmifolia
“ vulgare	“ cinerea
Philadelphus “Albatre”	“ corymbosa
“ cordifolius	“ fontenaysi alba
“ coronarius duplex	“ fritschiana
“ “ salicifolius	“ gemmata
“ “ speciosissimus	“ henryi
“ “Coupe d’Argent”	“ hypericifolia
“ “Gladwyne”	“ “ acuta
“ hirsutus	“ inflexa
“ grandiflorus	“ latifolia
“ “Innocence”	“ “ “Pink Flowers”
“ inodorus	“ longegemmis
“ insignis	“ lucida
“ lemoinei “Candelabre”	“ media
“ lewisi	“ menziesi
“ magdalenae X grandiflorus	“ microthyrsa
“ magnificus	“ miyabaei glabrata
“ “Mer de Glace”	“ mollifolia
“ “Mrs. Thompson”	“ multiflora
“ microphyllus	“ notha
“ nepalensis	“ nudiflora
“ nivalis	“ oxyodon
“ “Nuee Blanche”	“ pikoviensis
“ pekinensis brachybotrys	“ pubescens
“ “ kansuensis	“ rubra
“ polyanthus “Gerbe de	“ sansouciana
Neige”	“ semperflorens
Philadelphus satumanus	“ trichocarpa
“ schrenki	“ uratensis
“ “ jacki	“ virgata
“ “ mandshuricus	“ virginiana
“ sericanthus	“ “ serrulata
“ subcanus	Weigela decora
“ “Sylviane”	“ “Feerie”
“ tenuifolius	“ “Marc Tellier”
“ tomentosus	“ “Styriaca”
“ “Van Houttei”	“ “Verschaffelti”
“ “Velleda”	“ “Abel Carriere”
“ verrucosus	“ “Daubenton”
“ zeyheri	“ “Dr. Baillon”
Ptelea trifoliata aurea	“ “Floreal”
Sorbaria arborea	“ “President Duchartre”
“ “ glabrata	“ “Profusion”
Spiraea arcuata	“ “Vaniceki”

DONALD WYMAN



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

OCTOBER 17, 1952

NUMBER 8

AUTUMN COLOR

ALL indications point to a splendid display of autumn color this fall. There has been plenty of sunshine during September and rainfall has not been excessive. The nights during the first week of October have been very cool. All these indications thus point to the combination of conditions that should produce a fine display of color during the next week.

The eastern United States is fortunately located in one of the few regions of the world where brilliant autumn coloration of foliage prevails. There is only one small region in the southern hemisphere, and that in South America. In the northern hemisphere, there is a large region in eastern Asia, including central and northern Japan, and a small region in the southwestern part of Europe. In North America, the region characterized by brilliant autumn foliage extends from the Gulf of St. Lawrence to Florida and westward to the Great Plains, areas which are blessed with extensive deciduous hardwood forests and considerable rainfall. Here the general climatic conditions are often just what is needed to produce that lovely phenomenon of nature — the autumn coloration of deciduous foliage.

In North America the most brilliant displays of autumn color are of course in southeastern Canada, the northeastern United States and in certain other areas at higher altitudes. The further south one goes, the less brilliant is the display of autumn color, particularly in areas along the seacoast. In the higher altitudes of the South, such as the Blue Ridge Mountains and the Great Smokies, the color is just as brilliant as in the northeastern United States.

It should be pointed out that it is chiefly in areas of predominantly deciduous forests that autumn color displays are best, and such forested areas occur only in two general regions in the world. Plants growing in deciduous forests in tropical regions usually drop their leaves towards the end of the dry season. Since these leaves usually dry up before they fall (because of lack of water), they do not often develop brilliant colors. In the case of plants growing in deciduous forests in

temperate regions — especially in areas with ample rainfall equally distributed throughout the year—the leaves fall at the approach of cold weather, and because the plants have been well supplied with water, leaves of many trees do change color before they fall. This gorgeous phenomenon is what focuses our attention on the woods and forests at this time each year.

In some years, the autumn color is much more pronounced than in others. There are always plants, the foliage of which turn yellow in the fall, but it is the brilliant reds and gorgeous scarlets which, in combination with the yellows, make autumn color of outstanding beauty. It is chiefly the reds and scarlets which are intensified by the right climatic conditions.

Leaves are green because they contain a complex material called chlorophyll. This is essential to the growth of all plants, except the saprophytes and a few parasites, for it is through the action of chlorophyll that the plant can manufacture the food it requires from crude chemicals in the presence of light and heat. Chlorophyll is a highly complex chemical material, being continually manufactured in the leaf and at the same time being continually broken down. Ordinarily, the rate of its breakdown about equals the rate of its manufacture. In the fall, the rate of chlorophyll manufacture is gradually reduced, although the rate of its decomposition is maintained. The exact cause for this phenomenon is not fully understood, but the accumulation of waste products in the leaf may be the principal cause.

Why leaves are yellow

A certain stage is reached where there is little if any chlorophyll manufactured. Most of the chlorophyll already made eventually is destroyed. This is the reason why leaves are yellow, for the two yellow pigments usually present, carotin and xanthophyll, are continually masked by the chlorophyll. When most of the chlorophyll is destroyed, these pigments become apparent. These same coloring materials are present in large quantities in egg yolk, carrots, and in some yellow flowers.

When green plants are taken into dark places, such as a cellar, the leaves often turn yellow. Also, young shoots appearing for the first time under the dark conditions of the cellar are usually yellow. This is explained by the fact that chlorophyll is manufactured only in the presence of light. When light is absent, plants are unable to manufacture new chlorophyll and the yellow pigments become predominant as soon as all the previously manufactured chlorophyll has been destroyed.

The gradual cessation of chlorophyll manufacture and the final breakdown of all that previously made, complete the first stage in autumn coloration. This is the reason for certain plants becoming yellow. There are some plants, like some magnolias for instance, the leaves of which do not turn yellow, but change from green directly to brown. For some reason, the breakdown of the chlorophyll does not start soon enough or is not complete enough to result in the appearance of the yellow pigments. The yellow color does appear in the foliage of many other

plants regardless of the weather conditions. There is an interesting high degree of individuality in certain species. Red maple, for instance, usually turns a good red in the fall, but certain individuals may color yellow. The same can be said of sugar maples and several other plants. This is a most interesting physiological problem worthy of considerable investigation.

Why leaves are red

The gorgeous beauty of most autumn color combinations results from the brilliant reds and scarlets, together with the yellows. The sassafras, some of the maples, oaks, sumacs, sourwood, tupelo, and other plants are particularly outstanding for their brilliant red autumn color. These plants are most interesting in that the brilliance of their color apparently varies from year to year. The red in their leaves is caused by a third pigment called anthocyanin, which results in some way from the accumulation of sugars and tannins in the leaf. In some of the maples valued for their sugar production, it is probably the sugars which cause this red color. The oaks, however, being rich in tannins probably owe their high autumn coloration to the presence of these.

There are two factors necessary in the production of red autumn color. The first is light. There must be warm, bright, sunny days in the fall, during which time the leaves naturally manufacture a great deal of sugar. Secondly, such days must be followed by cool nights, during which the temperature is below 45° F. Plant physiologists have shown definitely that, under such conditions, there is little or no translocation of sugars and other materials from the leaf to other parts of the plant. In other words, when cool nights occur, following warm, bright, sunny days, sugars and other materials are "trapped" in the leaves. The accumulation of these products results in the manufacture of the red anthocyanin.

The combination of these factors is well understood when one observes a certain tree that may be red only on that side exposed to the sun. Other leaves not directly in the sun's rays may be green or yellow. Leaves exposed to the sun have been able to manufacture more sugars, which when accumulated and "trapped" in the leaves by cold night temperatures may result in the red color. It is interesting to note that trees and shrubs growing in swamps and other low places are often among the first to color in the fall, simply because they are in such places that cold air first settles on still nights.

With these points in mind, it can be easily seen why there is so much divergence of opinion about autumn color. When plants are located so that they receive full sunlight, especially in the late afternoons during the early fall, they should be expected to show pronounced color if the weather conditions have been favorable. On the other hand, if a plant grows in the shade where it receives no direct sunlight, it cannot be expected to have marked autumn color.

One species in the Arboretum annually demonstrates this point. There is a splendid plant of *Fothergilla monticola* in the shrub collection of the Arboretum.

This plant is exposed to full sunlight, while the shrub collection is in the lowest spot in the Arboretum, so one would normally expect plants there to color if any did. In years when the climatic conditions have favored autumn color formation, this particular plant of *Fothergilla monticola* is gorgeously colored red and yellow — **on the western side**. On the eastern side, where the foliage is shaded from the late afternoon sun, the foliage is merely colored yellowish and does not show the brilliant contrasts of red and yellow. Fortunately all plants do not show such great variation in autumn color when one side is compared with another, but it is a fact, that the western side usually has the deepest colored foliage when there has been plenty of sunshine. This point should be kept in mind in planting, locations and plants being selected that would show to best advantage during the period of autumn color.

Dull autumn coloration

A warm, cloudy fall, sometimes with much rain, will restrict the formation of bright colors in the foliage. With insufficient sunlight, the sugar production is greatly reduced, and with warm nights, what little sugar has been manufactured in the leaves can be readily transported to the trunk and roots where it has no effect on the color of the foliage.

The leaves of many evergreens change color in autumn. Some of the junipers and arborvitaes are listed in the following groups. Some pines may turn yellow, but usually such color lasts only for a short time, the leaves quickly turning brown. This is particularly true of those evergreen leaves which are normally shed each year, and although the autumn color may not be conspicuous in many evergreen plants, nevertheless it is evident on close examination.

All leaves eventually turn brown. This is not an autumn color, but is merely the result of the death, and in some cases the decay of the plant tissue. Sometimes, the leaves turn brown while they still remain on the tree, as in the American beech and in some of the oaks. In other cases, like the sugar maple and the spicebush, the leaves drop from the plants while they are still brightly colored and turn brown afterwards.

Autumn color is then a physiological phenomenon which is very complex. There are plants the leaves of which will always turn yellow regardless of current climatic conditions, but many of the plants with red fall foliage will be striking in appearance only when warm, sunshiny days prevail, followed by nights with temperatures below 45° F. The sugar formation in the leaf, the amount of sunshine received by the plants, and the temperature of the air are three variable factors which to a large degree control autumn coloration.

Woody plants with autumn color

The following plants are listed according to their most conspicuous autumn color. As has been explained above, these may change from year to year, depending on climatic conditions. For instance, some years *Cladrastis lutea* will be

yellow, other years the same trees will be purplish. The degree of color may also depend on soil conditions, it being a well-known fact that pin oaks, for instance, which have received heavy applications of nitrogenous fertilizers, will have a much deeper red color than those grown on poor soils without such fertilizers. With these qualifications in mind, the following lists are offered.

Autumn Color — Red

<i>Acer circinatum</i>	<i>Parrotia persica</i> — red to yellow
<i>ginnala</i>	<i>Parthenocissus quinquefolia</i>
<i>mandshuricum</i>	<i>tricuspidata</i>
<i>nikoense</i>	<i>Prunus maximowiczii</i>
<i>palmatum</i>	<i>sargentii</i>
<i>rubrum</i> — red and yellow	<i>Pyrus communis</i>
<i>schlesingeri</i> — very early red	<i>pyrifolia</i>
<i>spicatum</i> — orange and scarlet	<i>ussuriensis</i>
<i>saccharum</i> — red and yellow	<i>Quercus borealis</i>
<i>tataricum</i> — red to yellow	<i>coccinea</i>
<i>Amelanchier spicatum</i> — yellow to red	<i>palustris</i>
<i>laevis</i> — yellow to red	<i>velutina</i>
<i>Berberis</i> , many species	<i>Rhododendron calendulaceum</i>
<i>Carpinus caroliniana</i>	<i>schlippenbachii</i>
<i>Cornus alba</i>	<i>vaseyi</i>
<i>florida</i>	<i>Rhus aromatica</i>
<i>mas</i>	<i>copallina</i> — shining red
<i>stolonifera</i>	<i>glabra</i>
<i>Cotinus americanus</i>	<i>radicans</i> — red and yellow
<i>coggygria</i>	<i>typhina</i>
<i>Crataegus lavalleyi</i> — bronze-red	<i>Rosa rugosa</i> — red and yellow
<i>nitida</i> — orange to red	<i>setigera</i>
<i>phaenopyrum</i>	<i>virginiana</i> — red and yellow
<i>Enkianthus campanulatus</i>	<i>Sassafras albidum</i> — red, yellow to orange
<i>perulatus</i>	<i>Sorbus aucuparia</i>
<i>Euonymus alata</i>	<i>discolor</i>
<i>atropurpurea</i>	<i>folgneri</i>
<i>sachalinensis</i>	<i>Spiraea prunifolia</i> — glossy red
<i>Fothergilla species</i> — red and yellow	<i>Stewartia koreana</i> — orange to red
<i>Franklinia alatamaha</i> — red and yellow	<i>Syringa oblata dilatata</i>
<i>Liquidambar styraciflua</i> — red and yellow	<i>Vaccinium species</i>
<i>Malus dawsoniana</i> — red and yellow	<i>Viburnum dentatum</i>
<i>Nemopanthus mucronatus</i>	<i>lantana</i> — deep red
<i>Nyssa sylvatica</i>	<i>prunifolium</i>
<i>Oxydendrum arboreum</i>	<i>tomentosum</i> — velvety, dull red

Autumn Color — Reddish to Reddish Purple

<i>Cornus racemosa</i>	<i>Mahonia repens</i>
<i>Fraxinus americana</i>	<i>Pachistima canbyi</i>
<i>Gaultheria procumbens</i>	<i>Quercus alba</i>
<i>Gaylussacia brachycera</i>	<i>Thuja occidentalis ericoides</i> — purple
<i>Juniperus horizontalis plumosa</i>	<i>plicata</i> — bronze
<i>virginiana</i>	<i>Viburnum acerifolium</i>
<i>Leucothoe catesbaei</i>	<i>dilatatum</i>
<i>Mahonia aquifolium</i>	<i>lentago</i>

Autumn Color — Yellow

<i>Acer pensylvanicum</i>	<i>Hamamelis mollis</i>
<i>platanoides</i>	<i>vernalis</i>
<i>rufinerve</i>	<i>virginiana</i>
<i>saccharinum</i>	<i>Larix decidua</i>
<i>Actinidia arguta</i>	<i>laricina</i>
<i>Amelanchier species</i> — yellow to red	<i>Lindera benzoin</i>
<i>Asimina triloba</i>	<i>Malus halliana spontanea</i> — yellow
<i>Betula species</i>	<i>and purple</i>
<i>Celastrus species</i>	<i>Populus alba</i>
<i>Cercis canadensis</i>	<i>grandidentata</i>
<i>Cladrastis lutea</i> — yellow to purplish	<i>nigra italica</i>
<i>Clethra acuminata</i>	<i>tremuloides</i>
<i>alnifolia</i>	<i>Prinsepia sinensis</i>
<i>Ginkgo biloba</i>	<i>Pseudolarix kaempferi</i>

Autumn Color — Yellowish to Bronze

<i>Aesculus parviflora</i> — yellow brown	<i>Fagus grandifolia</i>
<i>Carya species</i> — yellow to brown	<i>sylvatica</i>
<i>Castanea dentata</i> — yellow to brown	<i>Magnolia stellata</i> — yellow brown
<i>mollissima</i> — yellow to brown	<i>Quercus imbricaria</i>

No Autumn Color

<i>Acer campestre</i>	<i>Clematis, many species</i>
<i>negundo</i>	<i>Corylus colurna</i>
<i>pseudoplatanus</i>	<i>Crataegus monogyna</i>
<i>Aesculus hippocastanum</i>	<i>Daphne mezereum</i>
<i>Albizia julibrissin</i>	<i>Davidia involucrata</i>
<i>Alnus glutinosa</i>	<i>Elaeagnus angustifolia</i>
<i>Baccharis halimifolia</i>	<i>Eucommia ulmoides</i>
<i>Carpinus betulus</i>	<i>Euonymus bungeana semipersistens</i>
<i>Cedrela sinensis</i>	<i>Fraxinus excelsior</i>

Hibiscus syriacus
 Juglans species
 Laburnum species
 Ligustrum vulgare
 Lonicera fragrantissima
 syringantha
 tibetica
 Lycium halimifolium
 Magnolia — most species
 Malus — many species

Polygonum auberti
 Potentilla species
 Prunus persica
 Quercus robur
 Robinia species
 Salix blanda
 pentandra
 Sophora japonica
 Vitex negundo

Autumn blooming shrubs

The display of color in the fall not only consists of colored foliage and bright colored fruits, but also includes the flowers of a few late blooming shrubs and vines. The sweet autumn clematis (*Clematis paniculata*) and the fleecevine (*Polygonum auberti*) are two vines whose white flowers have considerable merit in the fall.

Elscholtzia stauntoni is a fall flowering shrub from China which grows about four feet tall and has many spikes of small lilac colored flowers. It was first introduced into this country in 1905, and although it has not found its way into many gardens, it is listed by several nurseries.

Franklinia alata in the Arnold Arboretum begins to bloom about the first of September and continues until frost kills flower buds and leaves. The plants this year do not have many of their pure white, waxy flowers, due in large measure to the serious set-back the plants received in the prolonged drought this summer. Usually at this time they are covered with flowers. Though this native American plant is usually grown in the south as a tree, it is grown in the Arnold Arboretum as a shrub, with many branches from the base of the plant. When grown in this manner, winter killing is not nearly as severe as it is when the plant is grown as a tree, and, also, soil can be mounded around the base of the plant to aid in winter protection.

There are several members of the *Lespedeza* clan which are in bloom now. One of the most conspicuous this year is *Lespedeza japonica*, almost impossible to find in nursery catalogues, but a handsome, free-flowering shrub nevertheless, with its pure white flowers borne on conspicuous terminal spikes. Our plant is about four feet tall. *Lespedeza thunbergi* is also in full bloom, with pink flowers. It is only about three feet tall, and the flowers are not as conspicuous as those of *L. japonica*. The native witch-hazel (*Hamamelis virginiana*) is starting to bloom now, usually an indication that most shrubs have ceased flowering for the year. However, the unseasonably warm weather not only brought it into bloom ahead of schedule, but the flowers of many spring blooming shrubs are starting to appear here and there in the plantings also.

DONALD WYMAN

"The Arnold Arboretum—America's Greatest Garden"

This lecture is a series of 100 Kodachrome 2"×2" slides showing the best that is growing in the Arnold Arboretum, and is available to garden clubs for a small rental fee. As the slide collection in the Arboretum has grown, it has become possible to assimilate this lecture for the use of any garden club or interested group that wants it. Accompanying the slides is a typed list showing just what is portrayed in each picture. Also included is a 46 page booklet which gives some of the background and early history of the Arboretum, together with a general account of its many accomplishments up to the present time.

Since small kodachrome slides are universally used now, most people know that they are best shown in a completely darkened room, using a glass beaded screen. Small 100 watt projectors can be used when the image is small but for large groups, *air-cooled* lanterns (300-1000 watts) are highly superior and result in bringing out all the colors to best advantage on the screen.

Any individual who spends a little time studying the booklet, together with the notations about each slide (both common and scientific names of the plants are listed) would not have much difficulty in presenting this Arboretum story to a group.

The nominal rental fee is five dollars. It is hoped, that groups interested in the Arnold Arboretum and the thousands of plants growing there will avail themselves of this opportunity and so bring the Arboretum before many who can not visit it.

DEC 24 1952



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 12

DECEMBER 12, 1952

NUMBERS 9-12

THE HUNNEWELL ARBORETUM

1852-1952

THE Hunnewell Arboretum in Wellesley, Massachusetts, is an excellent living example of the results of the painstaking, costly, time-consuming efforts of one family, carried out through three generations. It has contributed greatly to our present knowledge of horticulture in the United States. This year marks the one hundredth anniversary of the establishing of this great garden, so it is fitting at this time to record a little of its earlier history and accomplishments.

Started over a century ago by Horatio Hollis Hunnewell, the Hunnewell Arboretum was continued and increased by his son, Walter Hunnewell, and his grandson, Walter Hunnewell, Jr. Now, a century after the first trees were planted, the hundreds of diverse plants growing there make a wonderful display, appreciated by those interested in trees and shrubs who come to visit it from all over the world. The information gleaned from there and freely given to all who ask for it, has been used widely throughout the gardening areas of the northern United States. The one hundred years of interest and care which have gone into the building of this great privately owned arboretum have resulted in new plants, some of which are widely used throughout the northern United States today; in the accumulation of a tremendous amount of knowledge concerning the trees and shrubs of distant lands; and in a magnificent collection of conifer trees, some of the specimens being the oldest (and largest) in America today. However, only a small part of the story is told by the plants existing there now.

A century ago, little was known about the hardiness of many plants native to the Midwest and the Pacific Coast when grown in the northeastern United States. Naturally, the trees and shrubs from foreign lands presented many unknown problems also for at that time there were no publicly operated arboretums. Very few plants were coming from China and practically none from Japan. Consequently, private individuals interested in trying new plants had to use the costly

and time-consuming method of trial and error in attempting to grow hardy types. In the case of this arboretum, thousands of plants were brought from European nurseries and planted at Wellesley in an attempt to find those that would prove hardy there. Even a larger number were purchased from American sources. American horticulture owes much today to the valuable contributions this New England family has made to our knowledge of plants during the past century.

Horatio Hollis Hunnewell

Horatio Hollis Hunnewell, the original founder of this arboretum, was one of two children of Dr. Walter Hunnewell, a physician who lived in Watertown, Massachusetts (1769-1855), and practiced medicine there for sixty years. Young Horatio was born in Watertown, July 27, 1810, and like most of the other children was educated in the lower schools there. When he was fifteen years old an opportunity came for him to go to France and learn the banking business with Welles & Co. His parents wanted him to make the final decision himself, concerning this opening, and it did not take him long. Like many another youngster, it may have been the thrill of going to a foreign country, or just the desire for adventure, that appealed to him. In any event, he crossed the ocean alone at fifteen and entered into the banking house of Welles & Co., in Paris, later becoming a partner in the firm.

On December 24, 1835, he married Isabella Pratt Welles in France, the daughter of John Welles, one of the partners of the firm for which he worked. (The Welles family lived in what used to be called West Needham, Massachusetts. Later — 1862 — the name of the U.S. Post Office was changed to Wellesley by a vote of the town in respect to this family which had done much for the townspeople and in 1881 the town was set off from Needham). Because of the serious French financial crisis of 1837 and the very difficult times thereafter, it became necessary to sell what was left of Welles & Co. As a result, Horatio Hollis Hunnewell came back to America in 1839 without a cent in his pocket but with a rich experience in banking behind him. He found he had to start life again at the bottom of the business ladder, but, although he had no college education, he was a keen business man and was soon on his way to acquiring a considerable fortune. He was connected with railroads in the East and Midwest for many years. Also he became interested in Boston real estate and served on the boards of many manufacturing companies. In 1860 the banking firm of H. H. Hunnewell & Sons was established.

Early in his life, Mr. Hunnewell acquired the hobby of raising plants. In his diary he writes (dated November 1838): "I did not take special interest in gardening in those days, being absorbed in business; but I will mention a circumstance that shows I did begin very early in life to do so, for when I could not have been more than a dozen years old I planted some cherry-stones in my father's garden, which came up and I budded them before leaving home. These trees my father sold, and sent me over fifty dollars as the proceeds; so the first money I

ever earned was in the nursery business." Mrs. Hunnewell inherited 20 acres of land from her father in West Needham and it was this land that eventually served as the center about which he acquired considerably more as he prospered in business, so that by 1851 he owned 137 acres. His very early interest in plants, his wife's ties with her home in West Needham, and his business ability which made it possible for him to practice horticulture on a very large scale even in those days, are the three factors contributing to the establishing, maintaining and enlarging of the Hunnewell Arboretum as it is now known.

Other interests kept Mr. Hunnewell very busy, many of them having a horticultural bent. He served as Vice President of the Massachusetts Horticultural Society from 1864 to 1874, as well as serving on many of its committees. A few of his many gifts included the Town Hall, Library and ten acres of land to the Town of Wellesley; the present Administration Building of the Arnold Arboretum in Jamaica Plain.

The Arboretum

Chronologically, the present plantings did not start until the new house was built in 1852 (the house now occupied by Mr. Walter Hunnewell, Jr.), but actually Mr. Hunnewell became very interested in country life in 1843 with the making of the first improvements about the property.

By 1846, Mr. Hunnewell was importing large numbers of evergreens, fruit trees and forest trees from England and by 1856 he started importing Rhododendrons in large numbers, having been urged into it through the enthusiastic reports of his friend and relative H. W. Sargent. Mr. Sargent returned from a trip to England and had been impressed with the universal use of rhododendrons throughout that country and their good looks everywhere they were grown. Three years later Mr. Hunnewell began introducing azaleas as well.

By 1847, 2,060 trees were imported from England and planted in his nursery. These included: Abies, Acer, Aucuba, Berberis, Betula, Buxus, Cedrus, Crataegus, Fagus, Ilex, Laburnum, Larix, Populus, Picea, Pinus, Quercus, Sorbus, Tilia, Taxus, Ulmus and Ulex species.

Some of these died later from poor conditions in transportation and lack of winter hardiness. It was about this time that the family definitely decided to pursue the country life and began enlarging upon the idea of planting, improving the soil, building the stone wall along Washington Street (1846), buying new tracts of land and eventually by building the house in 1852, overlooking Bullard's Pond, now called Lake Waban.

Mr. Hunnewell was able to do things on a large scale. In 1847, he noted that he raised some apple seedlings and budded 533 trees. Also in this same year he noted he had planted 1,922 trees, including: 591 evergreens, mostly firs, white pines and a few Norway spruce; 637 forest trees of a great many kinds, among them spruces, maples, ashes, elms, horsechestnuts, firs, mountain ash, Ailanthus, larches, chestnuts (Spanish and American), catalpas, magnolias, lindens, alders,

butternuts and acacias; 290 peach trees; and 404 apples, pears, cherries, etc.

In addition, there were 4,000 seedling trees in the nurseries, some of which were "of good size" according to his diary. This was a sizeable accumulation of woody plants from which to select specimens for planting about the estate.

When Mr. Hunnewell moved into the new house in 1852 (the conservatory was added in 1866) very little had been done to improve the land adjacent to the house. The lawn was an old pasture almost entirely "run out," having been neglected for many years. The only specimen tree on the place at that time was a white oak which is still growing in excellent condition. However, he immediately began to change this. It was not long before he had to find places for some of the plants in his ever increasing nursery. Continual notes were made in his diaries concerning the plantings that he made from 1856 on.

There is also an almost continual record of changes, enlargements and additions to the greenhouses and wintering pits. There was an orangery, grapery, and orchid house, and some of these have been continued to the present time. When the decision was made, shortly after 1902, to do away with wintering so many tender plants in tubs, naturally some of the pits were abandoned.

As time went on, and newer importations of plants were made from western North America and abroad, the Hunnewell Arboretum became the outstanding garden of its kind in New England if not the entire eastern United States. It was here that hundreds of visitors came to see the native and exotic plants that they could not see or study elsewhere. Later, when the Arnold Arboretum was established in 1872, Charles Sprague Sargent, the young director, familiarized himself with the plantings of the Hunnewell Arboretum. It was undoubtedly here that he learned much about the hardiness of certain plants that had never been tried elsewhere, and also gained much information concerning their culture and propagation.

Mr. Hunnewell was fortunate in being able to import plants from abroad long before the restrictions concerning soil about the roots. Because of this, he was able to receive larger plants and, all in all, had reasonably good success with their survival on arrival here. The majority of all his rhododendrons he noted (1894) came from the firm of Anthony Waterer and Sons, Woking, England. Other plants were received from Kew Gardens, Van Houtte, Reuthe (in England) and many others. Prominent European horticulturists and botanists were continually visiting his place, for, in the early days, it was the only meritorious collection of evergreen plants in the eastern United States. In fact, Charles S. Sargent wrote in *Garden and Forest* (1892) that it was "unsurpassed in the number of species and varieties of these trees that it contains and in the size and beauty of individual specimens."

In the later years, the Hunnewell Arboretum began receiving seeds and plants from the Arnold Arboretum. Jackson Dawson, Charles S. Sargent, Ernest H. Wilson and William H. Judd were continually giving plants. The Hunnewells



PLATE XIII

The main house, completed in 1852, with *Liriodendron tulipifera* on the left and *Fagus sylvatica pendula* on the right. Both these trees are nearly one hundred years old and the branches have taken root where they have rested on the ground.

contributed to several of the expeditions made by E. H. Wilson, so that when the seeds from these expeditions were distributed, the Hunnewell Arboretum was able to grow seedlings as quickly as the Arnold Arboretum. As a result, many of the specimens now living which resulted from these expeditions, are at their best in the Hunnewell Arboretum, and in fact are among the oldest, if not the oldest, in North America.

Walter Hunnewell, Sr.

When Walter Hunnewell, Sr. inherited the Arboretum in 1902, he gradually began to make changes. This was in the day when station agents along the railroad were still spelling out the names of the stations with bedding plants. Walter Hunnewell was less interested in tender plants, feeling that to be worth while here in New England, a plant should be perfectly winter hardy. As a result, the tender plants that had been brought out to the garden in tubs for so many years, later to be wintered over in pit houses, were gradually discarded.

Deciduous plants were seldom a feature. Rather, time, labor and interest were spent on the evergreens. Today there are still many beautiful deciduous trees and shrubs on the grounds, but the evergreens, always given the preference in care and space, are the featured attractions. From 1902 until the present the area of the arboretum and grounds has remained about 40 acres.

Mr. Hunnewell's diary contains many notes from 1915 to 1921 concerning the hardness of plants and the weather conditions responsible for certain plant reactions. He was not without his troubles as far as growing plants were concerned for in 1915 he noted that serious rhododendron injury that spring was due to a bad drought the preceding autumn. Gypsy moth was noted in 1915 and the first time a lilac "blight" hit the lilacs was in 1921. This disease has been prevalent in the Arnold Arboretum in the rainy spring of 1952. Rhododendron lace fly is mentioned as being completely absent in 1915, resulting in excellent plant growth.

Some of the weather notes are interesting. For instance, in July 1915, there was nine inches of rain, the heaviest in forty years. The winter of 1915-16 produced a snowfall of eighty inches with eight inches of it coming on April 28. The winter of 1917-18 was, in Mr. Hunnewell's words, "the most extraordinary I can remember in my life time. Between December 22nd and February 5th, we have had only six days during which the thermometer has been over 32 degrees for an instant." Also a heavy frost occurred on the night of June 21 killing all vegetables in low spots but the Hunnewell vegetables were fortunately saved by the continual operation of the Skinner irrigation system. Many hemlocks and oaks were badly injured or killed this same winter. A large tree of *Pinus lambertiana* was killed outright. *Leucothoe catesbaei* and *Pieris japonica* were badly injured as well as some of the native red cedars. It was one of the most severe winters on record from the standpoint of plant injury, but many of the plants killed to the ground, made a rapid recovery, especially the azaleas.

In February 1920, he notes that the depth of snow on the ground in Wellesley was 59.7 inches, a heavy enough layer to injure and break the branches of many rhododendrons. The reading of these notes and records proves most interesting, adding to our knowledge of the plants which are on the borderline of hardiness here in New England.

Walter Hunnewell, Jr.

Mr. Walter Hunnewell, Jr., the present owner, inherited the arboretum on the death of his father in 1921 and has persistently carried out the precepts of his father and grandfather. He has added many plants to the collections, and has kept the pinetum open to the public and especially to the students of Wellesley College (which borders the grounds). He has continued the generous policy of always giving specific information concerning his plants and his experiences with them, to the many who are continually seeking information there. Interesting hybrids have arisen in this collection and propagating material has been distributed.

He, too, has been particularly interested in the Pinetum and in the rhododendrons, and has recently been especially persevering in his efforts to promote good growth among the hundreds of the older rhododendrons. He has been a Trustee of the Massachusetts Horticultural Society since 1925 and has served as Vice President and as Treasurer of that organization. He has also served long and faithfully on many of its important committees and at the same time has kept an active interest in many other horticultural organizations. His continued efforts to keep the plants of the arboretum in good condition, to add new species and varieties where possible, to continue experimentation with their culture, makes this collection one of the outstanding private collections of conifers and rhododendrons in America today.

The Gardeners

Right here a word of praise must be made to the three gardeners responsible for the maintenance of this collection over the first century of its operation. Mr. F. L. Harris was the first head gardener, coming to the employ of Mr. H. H. Hunnewell about 1854. Continuing after that until he retired in 1900, he was in charge of the arboretum and greenhouses, and died three years later at the age of 80. It was Mr. Hunnewell who had the vision of what to plant and where to plant, but undoubtedly Mr. Harris contributed greatly to the success of the arboretum as a whole from his years of practical knowledge of growing plants.

Mr. Theophilus D. Hatfield was employed by Walter Hunnewell, Sr., on his place adjacent to his father's for thirteen years prior to 1900. In that year, Mr. H. H. Hunnewell, knowing that his son Walter would eventually inherit the arboretum, took Mr. Hatfield to "break him in." Consequently, in 1902, when Mr. H. H. Hunnewell died, Mr. Hatfield had already become well acquainted with all the plants. Trained in Kew Gardens, England, he had a rich and practical background. He was continually seeking new information and contributed

many articles to the gardening and horticultural magazines of the times. Some of the plants originating in this arboretum were the results of this keen interest and knowledge. The Hunnewells were indeed fortunate in having T. D. Hatfield to serve them until his death in 1929.

The third superintendent was John Ellis, another graduate of Kew Gardens, who came in 1930 and is the present superintendent. Mr. Ellis also is a great horticulturist and brings to the arboretum a great knowledge of growing plants. His knowledge and experience is respected and frequently sought by all who are interested in growing rhododendrons and coniferous plants in New England.

Topiary Garden

Mr. H. H. Hunnewell started what he termed the "Italian Garden" in 1851, described by Downing in his "Landscape Gardening" in 1858. This was a series of evergreen trees, planted on a two acre bank by the lake, which were clipped and pruned in special ways, similar to what was done in certain Italian gardens of those times. Once there were 200 trees here. The steep bank rose 75 feet in a very narrow space, and Mr. Hunnewell constructed a series of seven terraces. He always felt that this treatment and type of planting was the best he could have possibly made to utilize the space in an interesting manner, while at the same time not cluttering up the beautiful view of the lake.

The disadvantages of growing these plants unnaturally were known to him, of course, but it has always been of great interest to visitors. It is the oldest topiary garden in America today and one of the very few where the effects of this type of pruning can be observed on evergreens.

When they grew well, the trees used to be clipped twice a year. T. D. Hatfield records that it was frequently difficult to keep the plants in good condition and that frequent replacements had to be made. However, in the time that he was there (1902-1928) it was the part of the estate that changed the least. Completed in 1859, Mr. Hunnewell noted in his diary that during the next twenty years, nothing of importance had occurred concerning it. In 1898 the following trees were growing there: 34 *Chamaecyparis pisifera* and vars.; 8 *Fagus* sp.; 17 *Juniperus virginiana*; 10 *Larix decidua*; 8 *Picea abies*; 30 *Pinus strobus*; 32 *Thuja occidentalis*; 25 *Tsuga canadensis*.

Many of these are still growing. Additional species like *Taxus cuspidata* were added later. This whole project was really an innovation on Mr. Hunnewell's part for he had to use mostly at the beginning, plants native to North America. In Europe the topiary was done chiefly with English Yew and other native European plants, but he could not purchase European plants sufficiently large to make an initial planting worthwhile and some of these species would not have proved hardy anyway.

Rhododendrons and Azaleas

Apparently it was in 1856 that Mr. H. H. Hunnewell first began importing



PLATE XIV
The Topiary Garden borders Lake Waban.

rhododendrons in large numbers, after being interested in these plants by H. W. Sargent, his friend and relative. Mr. Sargent returned from a trip to England very enthusiastic about the growth and universal use of rhododendrons in that country. Three years later Mr. Hunnewell also began collecting azaleas. His enthusiasm for these plants increased with the numbers of specimens that he purchased from abroad, and it was not long before his plantings of rhododendrons and azaleas became one of the outstanding spring shows in New England. He wrote in his diary: "It is my opinion that the *Rhododendron* is the most ornamental shrub we can grow in our climate and so I give it a most decided preference over all others. Some persons may prefer the lilacs which we all admit have much to recommend them, but how is it when they are not in flower, which is a large portion of the year? Are they not an eyesore, rather than an ornament in a very conspicuous place, such as this? Of this there is no doubt in my mind." Time and again mention is made of this excellent rhododendron display in the records of the Massachusetts Horticultural Society and gardening magazines of the times. He is to be given credit for pioneering in the culture of rhododendrons in North America.

Every variety it was possible to obtain from European nurseries, Mr. Hunnewell tried. Undoubtedly he should be given full credit for being the introducer of many varieties into North America from abroad. Unfortunately his earlier records do not contain many specific notes to dates of introduction of specific varieties, but he was importing them in large numbers before others in this part of the world had come to realize their true ornamental value. Many varieties which were at first too tender for New England were tried over and over again in the hope they might be hardy. In fact, Mr. Hunnewell sensed that popular interest was so great in these plants that he wanted to do something more than just open his gardens at Wellesley to visitors. As a result, he is credited with staging the first *Rhododendron* Flower Show in America, on the Boston Common in 1873.

For years thereafter, the Hunnewells have taken many prizes in many shows for their excellent rhododendrons. Today, the plantings of these shrubs are still among the best and most colorful in New England. The Hunnewells deserve a great deal of credit for starting the interest in growing these valuable ornamental plants in the northern United States, as well as for growing them continually during the past century and learning so much about their hardiness and culture.

After the death of Mr. H. H. Hunnewell, his son became more and more interested in the plants which were completely hardy out of doors in New England's winter. As a result, the many tender rhododendrons which previously had been kept in tubs, moved into pits in the winter and out of doors in the late spring, were either sent away to the DuPont's at Kennett Square, Pennsylvania; to the Missouri Botanic Garden; to South Carolina, or left continually out of doors at Wellesley. Gradually, the really hardy ones became known.



PLATE XV

Rhododendrons have always been a prominent feature of the Hunnewell Arboretum.

Azaleas also interested Mr. H. H. Hunnewell at an early date, but many of the ones he imported from England were tender sorts which had to be placed in the pit house for winter. Some of the Ghent hybrids were imported as early as 1878. Walter Hunnewell became interested in the Ghent and Mollis hybrids, but T. D. Hatfield noted that by 1929, most of the Mollis types had disappeared because they were so susceptible to borer attack. There are still some excellent Ghent hybrids remaining.

Early in the twentieth century, the Hunnewells obtained some of the seeds of rhododendrons and azaleas collected by E. H. Wilson in China and Japan. At about this time, the azalea species which were being grown in the arboretum (in the order of their flowering) were: *Rhododendron dauricum*; *mucronulatum*; *vaseyi*; *schlippenbachii*; *reticulatum*; *obtusum kaempferi*; *yedoensis poukhanensis*; *quinquefolium*; *nudiflorum*; *roseum*; *canadensis*; *japonicum*; *calendulaceum*; *molle*; *viscosum*; *arborescens*.

Jackson Dawson of the Arnold Arboretum gave Mr. Hatfield some small plants of *R. japonicum* which Mr. Hatfield crossed with *R. molle*. The resulting hybrids were the first authentic crosses between the Chinese and Japanese species and one of the dark orange colored clones was given the name "Miss Louisa Hunnewell" after one of the daughters of Walter Hunnewell (Sr.). The large flowers, fully two or more inches across, are produced in large rounded heads of a rich brilliant yellow color, with the slightest tinge of red, taken from the Japanese species. Its freedom of growth, profusion of bloom, size of flowers and cheerful brilliancy of color commend it in every way. It is one of several plants which originated in the Hunnewell Arboretum.

Another hybrid which Mr. Hatfield made was *R. canadensis* \times *R. japonicum*. The Arnold Arboretum had a plant of this sent it by a Mr. Fraser from the Pacific Coast. The true identification of this plant was doubted and Mr. Hatfield was asked to make the cross again which he did, and the resulting seedling proved to be identical to Mr. Fraser's plant. In this particular instance several hundred plants were raised but only six had vitality enough to live and carry on. Incidentally, Mr. Hatfield attempted crossing a large number of azaleas. The progeny of several always turned out to be "mules"—seedlings seldom living more than two or three years. Also he tried *R. speciosum* crossed with *R. calendulaceum* and *R. japonicum*, but he never succeeded in getting more than two or three percent of these to make real plants.

(Note: For additional listing of tender species and varieties over the years as well as for list of rhododendrons growing in 1952, see main list, pages 78-81).

In 1928, T. D. Hatfield listed the hardy rhododendrons (as a result of their year's of growth in the Hunnewell Arboretum) as follows:

<i>R. Album Elegans</i>	Abraham Lincoln
<i>Album Grandiflorum</i>	Baroness Henry Schroeder
<i>Alexander Dancer</i>	Butlerianum

R. Boule de Neige
 Caractacus
 carolinianum
 “ album
 catawbiense
 caucasicum album
 Charles Bagley
 Charles Dickens
 C. S. Sargent
 Delicatissimum
 E. S. Rand
 Everestianum
 fargesii
 F. L. Ames
 General Grant
 giganteum
 Gormer Waterer
 Henrietta Sargent
 H. W. Sargent
 James Mackintosh
 James Bateman
 Kettledrum
 Lady Clermont
 Lady Armstrong
 Lady Gray Egerton
 Lady Rolle
 Lady Hillingdon

Mme. Carvalho
 Marquis of Waterford
 maximum
 Minnie
 micranthum
 “ longistylum
 minus
 Miss Caroline Hunnewell
 Mrs. C. S. Sargent
 Mrs. John Clutton
 Mrs. Milner
 Mrs. Charles Thorold
 Mrs. Simpson Mum
 Old Port
 praecox
 Princes Mary of Cambridge
 Princess Victoria
 Prometheus
 punctatum
 Ralph Sanders
 Scipio Sultana
 smirnowi ungerni
 sutchuenense
 The Bride
 venustum
 wellesleyanum
 wilsoni

The Pinetum

After he moved into the new house (1852) Mr. H. H. Hunnewell planted several kinds of evergreens about the grounds. Six *Abies nordmanniana* and six *Abies pinsapo* imported from Europe were planted in 1858. *Abies nobilis* and *A. cephalonica* received from Webber were planted in 1861. *Abies sibirica*; *Chamaecyparis lawsoniana*; *Picea abies compacta*; *Pinus excelsa*, *monticola* and *ponderosa* were all planted in 1862. So, there was a growing interest in evergreen trees which culminated in the following statement written by Mr. Hunnewell in his diary under the date of April 1867: “It will be my aim to plant in it (the Pinetum) every conifer, native and foreign, that will be found sufficiently hardy to thrive in our New England climate.”

The actual work starting the Pinetum began in September 1866, when he noted in his diary on September 26, 1866, “Commenced improving piece of land, bought last year of Darling for a Pinetum.” Since this time, plants have been continu-

ally planted, introduced from all parts of the northern hemispheres. Many were undoubtedly brought to America for the first time. After the establishment of the Arnold Arboretum in 1872, the Hunnewells were generous contributors to the various expeditions of E. H. Wilson and frequently they received small amounts of his original seed collections. These were immediately grown, and as a result, many of the trees in the Hunnewell Arboretum are among the tallest and oldest of their kinds in America today.

The story of this Pinetum is a lengthy one, and can not be told in a few printed pages, for the successes and failures were many. For instance, it took Mr. H. H. Hunnewell thirty years of experimenting with various clones of *Thuja plicata* from the Pacific Coast until he finally found a form that was hardy here in New England, a form which is widely grown here today. *Abies fraseri* was repeatedly tried, with little success, until a form was finally obtained from near the northernmost limits of its habitat in the South, and this did well. The white fir from California also was tried for many years, unsuccessfully, until a form was finally introduced from Colorado which has proved perfectly hardy over the years. This is now widely planted in the gardens of the northern United States.

Abies amabilis was still another western species tried for many a long year. In fact, plants were nearly fifty years old and only twelve feet tall before it was realized that *Abies homolepis*, growing close by for the same length of time and forty five feet tall, was a superior tree for this eastern area.

Many individual trees are still of great interest. There is an old white oak near the house which was the only tree on the pinetum grounds a hundred years ago and it is still in excellent condition—easily 60 feet high and with a spread of 80 feet. The old Norway spruce on the front lawn is undoubtedly one of the oldest in New England. It is so old that several young trees fifteen feet and more in height have sprouted from these layered branches which have rested on the ground for many years.

The century of careful experimentation with the growth and culture of these plants has resulted naturally in the production of many new ones. *Taxus media* and *Taxus media hatfieldi* are meritorious additions to the ornamental woody plants hardy in the northern United States and both are now widely grown. One interesting pine now nearly twenty feet tall is probably a cross between *Pinus strobus* and *P. parviflora*, and has caused considerable interest. These are only a few, others are recorded in the following list.

The hundreds of evergreen trees and shrubs growing in this arboretum are evidence enough of what has gone before. *Abies cilicica* one hundred feet high, the hardy strain of *Cedrus libani* nearly fifty years old and bearing large quantities of cones, dwarf forms of the Norway spruce nearly thirty feet in diameter and a *Taxus cuspidata densa* nearly thirty feet across—these are only a few of the splendid specimens as they are today.

The continual gleaning of information in the Hunnewell Arboretum during the

past century has not been publicized as well as it merits. Rather it has been undertaken in a quiet way, with information freely given when it was asked for, with visitors courteously admitted to the grounds at all times. The Hunnewells have been staunch supporters of the Massachusetts Horticultural Society and have been displaying plants in the various flower shows of the Society continually since 1856. The record of prizes won is long indeed. And so, although many a gardener fails to realize it, we have to thank the persistent efforts of three generations of Hunnewells for some of the plants we freely grow today and many of the practices we have freely adopted, all of which have resulted from their long and costly experiments in growing plants at Wellesley.

A Few of the Woody Plants Grown in the Hunnewell Arboretum 1852-1952

The dates given here are *approximate* only, being the dates on which the plants were first mentioned in the Hunnewell diaries or in the articles and records of Mr. Hatfield. Plants recorded as still present are not necessarily the original plants since these have died or been removed in many cases and others have been planted later. Mr. H. H. Hunnewell was introducing plants prior to 1852 and where these dates are known they are listed here. Frequently a plant was growing in the arboretum for many years before specific mention was made of it in the above records. This is not a complete list by any means, for hundreds of other plants including orchids, greenhouse plants and various kinds of fruits were grown. Nor is this a complete list of the plants now growing in this arboretum. It is merely a selected list, to show some of the interesting woody plants and especially some of those which may have been original or very early introductions.

O = Conifers and rhododendrons present in 1952.

‡ = Plants that may have been introduced by the Hunnewell Arboretum, or in many cases, jointly introduced with the Arnold Arboretum (after 1872).

§ = Plants originating in the Hunnewell Arboretum.

O	Abies alba - 1847	‡O	Abies holophylla - about 1905
‡	“ “ columnaris - 1868	‡O	“ homolepis - about 1870
O	“ amabilis - about 1862	‡O	“ koreana - 1908
O	“ cephalonica - 1860	O	“ lasiocarpa arizonica
O	“ cilicica - about 1870	‡	“ mariesi - 1879
‡O	“ concolor - 1867 (hardy form)	O	“ nephrolepis
O	“ “ violacea - 1890	“	“ nobilis - 1867
‡	“ fargesii - about 1902	O	“ nordmanniana - 1860
“	faxoniana - about 1902	O	“ recurvata
O	“ fraseri - 1867	O	“ sachalinensis nemorensis -
‡	“ grandis - 1867		about 1914



PLATE XVI

Abies cilicica planted in 1870 and now the tallest tree in the Hunnewell Arboretum.

- O *Abies sibirica* - 1867
 O “ *veitchi* - about 1880
 O *Acer henryi* - before 1902
 Aurucaria imbricata - 1867
 Berberis buxifolia - 1847
 O *Buxus sempervirens* - 1847
 O *Cedrus libani* - 1847
 Cephalotaxus fortunei - 1867
 Chamaecyparis lawsoniana - 1867
 O “ *obtusa* - 1880
 O “ “ *lycopodoides*
 1892
 O *Chamaecyparis obtusa nana* - 1892
 O “ *pisifera* - 1880
 “ *ericoides* -
 1867
 O *Chamaecyparis pisifera filifera* - by
 1892
 O *Chamaecyparis pisifera* “*filifera*
 aurea” - by 1892
 O *Chamaecyparis pisifera plumosa*
 O “ “ *leptoclada* -
 by 1892
 O *Chamaecyparis pisifera squarosa* -
 about 1880
 O *Chamaecyparis pisifera* “*squarosa*
 nana”
 O *Chamaecyparis thyoides*
 Cryptomeria japonica - 1867
 O “ “ *lobbi*
 Cunninghamia lanceolata - 1867
 Cytisus multiflorus - 1847
 O *Fagus sylvatica* - 1847
 O “ “ *pendula*
 O “ “ *purpurea* - 1847
 O *Ginkgo biloba* - about 1855
 O *Juniperus chinensis* - 1867
 O “ “ *japonica*
 O “ “ *pfitzeriana*
 O “ *rigida*
 “ *communis suecica* - 1867
 O “ *formosana*
 Juniperus oblonga pendula - 1867
 “ *sabina* - 1867
 “ “ *tamariscifolia* 1867
 †O “ *scopulorum* - 1890
 O “ *squamata* - 1867
 O “ “ *meyeri*
 “ *thurifera* - 1867
 O “ *virginiana glauca*
 †O *Larix eurolepis* - 1907
 † “ *leptolepis* - probably 1861
 O *Libocedrus decurrens*
 Ligustrum japonicum - 1847
 “ *lucidum* - 1847
 O *Metasequoia glyptostroboides*
 O *Picea abies* - 1852
 † “ “ *clanbrasiliana* - 1867
 † “ “ *compacta*
 † “ “ *elegans*
 †O “ “ *gregoriana*
 † “ “ *pygmaea*
 † “ “ *pumila*
 † “ “ *pyramidalis*
 O “ “ *septentrionalis*
 †O “ *asperata* - 1910
 †O “ “ *notabilis* - 1909
 †O “ “ *ponderosa* - 1910
 O “ *aurantiaca* - 1910
 O “ *bicolor* - 1870
 O “ *brachytyla*
 O “ *breweriana*
 O “ *engelmanni* - 1890
 O “ *glauca* - about 1854
 O “ “ *albertiana*
 O “ “ *conica*
 †O “ *glehni* - 1892
 O “ *jezoensis* - 1890
 “ “ *honodensis* - about
 1890
 O “ *koyamai* - 1919
 O “ *likiangensis balfouriana*
 O “ *mariana doumeti* - 1900
 “ *maximowiczii* - about 1895

†O *Picea montigena* - 1908
 O " *obovata*
 O " *omorika* - 1890
 O " *orientalis* - 1867
 O " *polita* - 1880
 †O " *pungens* - 1862
 O " " *compacta* - before
 1900
 §O " *pungens hunnewelliana* - be-
 fore 1923
 †O " *purpurea* - 1910
 O " *retroflexa*
 O " *rubra*
 O " *wilsoni*
 O *Pinus armandi* - by 1905
 " *banksiana* - about 1860
 O " *bungeana* - 1902
 O " *cembra* - 1867
 O " *cembroides edulis*
 O " *densiflora* - about 1872
 O " *echinata* - by 1905
 O " *flexilis* - by 1902
 O " *koraiensis* - about 1870
 " *griffithi* - 1867
 " *lambertiana* - 1867
 O " *monticola* - 1867
 O " *mugho mughus*
 O " " *rostrata*
 O " *nigra austriaca* - 1867
 " *nepalensis* - by 1905
 O " *parviflora* - by 1905
 O " *peuce* - 1894
 O " *ponderosa* - 1867
 O " *resinosa*
 O " *sibirica*
 " *strobis nana* - by 1900
 O " *sylvestris*
 O " *tabulaeformis*
 O " *thunbergi*
 Populus tacamahaca - 1847
 Prunus lusitanica - 1847
 O *Pseudolarix amabilis* - 1867

O *Pseudotsuga taxifolia* - 1847
 Pyracantha - 1847
 O *Quercus robur* - 1847
 Rhododendron
 O *catawbiense* - hardy 1890
 O " *album* - hardy 1905
 O *carolinianum*
 gandavense hybrids - 1877
 O *maximum*
 O *minus*
 O *obtusum amoenum* - 1871
 O *smirnowi*
 O *sutchuenense*
 O *wellesleyanum* - before 1905
 Rhododendrons and Azaleas
 (Many of these varieties were un-
 doubtedly first introductions, but
 because accurate data is lacking,
 it is impossible to list the intro-
 ductions here.)
 O *Abraham Lincoln* - 1928
 Adrian Lothiar - 1889
 O *Album Elegans* - hardy 1905
 O " *Grandiflorum* - 1895
 O " *Nova*
 Alexander Adie - 1889
 O *Alexander Dancer* - hardy 1905
 O *America*
 O *Amphion*
 §O *Apple Blossom*
 Arthur Helps - 1889
 O *Atrosanguineum*
 Auguste Van Geert - tender 1905
 Aurora - 1889
 Bacchus - hardy 1890
 Bacon Dyke - 1889
 Baroness Lionel Rothschild - 1889
 Baroness Schroeder - 1890
 O *Beethoven*
 Blanche Superba - tender 1905
 Blue Bell - 1894
 O *Boule de Neige* - 1928

- Brightoni - 1889
 Brittonia - tender 1928
 Brookline Seedling - 1905
 O Butlerianum - before 1928
 Bylsianum - 1889
 O Candidissimum
 Captain Webb - 1889
 O Caractacus - 1890
 §O Caroline H. Blake
 O Charles Bagley - hardy 1889
 Charles Napier - hardy 1889
 O Charles Dickens - hardy 1890
 Charlie Waterer - tender 1905
 Chelsoni - 1889
 Chevalier Felix de Sauvage - 1889
 Christiana - 1895
 Claude - hardy 1890
 Claude Pardoloton
 Coerulescens - hardy 1905
 Concessum - 1890
 Cottage Maid
 O Countess of Athlone
 Countess of Clancarty - 1890
 Countess of Morello - tender 1905
 Countess of Normanton - 1893
 Countess of Pourtalis - 1889
 Crown Prince - tender 1905
 Cruentum - 1889
 O C. S. Sargent - 1890
 O Cunningham's White
 Cynthia - 1893
 O Delscatissimum - 1890
 O Doncastum
 O Dorothy
 O Dr. H. C. Dresselhuys
 O Dr. V. H. Rutgers
 Duchess of Bedford - 1890
 Duchess of Connaught - 1889
 Duchess of Edinburgh - 1889
 Duchess of Sutherland - 1889
 Duke of Teck - 1895
 Earl of Haddington - 1889
 Eclipse - tender 1905
 O Edward S. Rand - hardy 1890
 O Everestianum - hardy 1905
 Exquisite - 1889
 Fastuosum - 1894
 O F. D. Godman - 1889
 O F. L. Ames - 1895
 Francis Dickson - 1889
 Frederick Waterer - 1889
 O General Grant - 1928
 George Hardy - 1889
 George Paul - 1893
 O Glennyanum
 Gloriosum - hardy 1905
 O Gormer Waterer - 1889
 Grace Darling - 1890
 Grand Arab - 1889
 Guacino - 1889
 Guido - 1889
 Hamlet - 1895
 O Hannibal
 Hector - 1889
 Helen Schiffner - 1905
 Helen Waterer - 1889
 O Henrietta Sargent - 1905
 Henry Bohn - 1889
 §O H. H. Hunnewell - 1889
 O H. W. Sargent - hardy 1890
 Isaac Davies - hardy 1890
 Isabel Mores - 1889
 Isago - 1892
 O Ignatius Sargent
 James Bateman - hardy 1890
 James Macintosh - hardy 1889
 James Mason - 1890
 James Nasmyth - hardy 1890
 §O Jane Peele
 Jean Byles - 1889
 §O Jean Ellis
 §O Jill Saunders
 J. Marshall Brooks - hardy 1889
 O Johann Strauss

- John Henry Agnew - 1894
 John Kelb - 1889
 John Spencer - 1890
 O John Walter - 1893
 John Waterer - 1889
 O Kate Waterer - 1889
 O Kettledrum - hardy 1890
 Kewense - tender 1928
 King of the Purples - hardy 1905
 Lady Annette de Trafford - 1889
 O Lady Armstrong - 1890
 Lady Dorothy Neville - tender
 1905
 Lady Frances Crossley - hardy
 1905
 O Lady Clermont - Hardy 1889
 O Lady Gray Edgerton - hardy
 1889
 O Lady Hillington - 1901
 Lady Lopez - 1889
 Lady Olive Guinness - tender
 1905
 O Lady Rolle - 1895
 Lady Tankerville - 1889
 Lord Eversley - 1889
 Lord John Russell - 1889
 Lord Palmerston - 1889
 O Lord Roberts
 Lord Sefton - 1905
 Lord Selborne - 1889
 §O Louisa Hunnewell - before 1915
 O Luciferum
 Lucidum - tender 1905
 Maculatum superbum - hardy
 1890
 O Mme. Carvalho - 1889
 O Mme. Masson
 Mme. Jean Penn - 1889
 Mme. Piccoline - 1889
 Mme. Wagner - tender 1905
 Mlle. Marie Closson - 1890
 Maggie Heywood - 1893
 Marchioness of Lansdowne - 1889
 Marie Stuart - tender 1905
 O Marquis of Waterford - 1928
 Martin Hope Sutton - 1889
 Maxwell T. Masters - hardy 1905
 Melton - 1905
 Meridan - 1889
 Meteor - hardy 1890
 Michael Waterer - 1889 - tender
 O Minnie - hardy 1889
 Miss Buller - 1889
 §O Miss Caroline Hunnewell - 1928
 Miss Jekyll - tender 1905
 Miss Mary Ames - hardy 1905
 Micrandum - hardy 1905
 O Mozart
 Mrs. Arthur Hunnewell - 1889
 tender
 O Mrs. Charles Thorold
 O Mrs. C. S. Sargent
 Mrs. Frederick - 1928
 Mrs. Frederick Hankey - 1889
 half hardy
 Mrs. Heywood - 1889 - tender
 Mrs. Harry Ingersoll - 1893
 Mrs. H. S. Hunnewell - 1895
 O Mrs. John Clutton - 1889
 Mrs. John Kelk - hardy 1905
 Mrs. Penn - 1892
 Mrs. J. P. Lade - 1895
 O Mrs. Milner - 1890
 O Mrs. P. den Ouden
 Mrs. R. G. Shaw - 1898
 Mrs. R. S. Holford - 1889
 Mrs. Russell Sturgess - 1889
 tender
 Mrs. S. Simpson - hardy 1905
 Mrs. Shuttleworth - 1890
 Mrs. Thomas Wain - hardy 1889
 Mrs. Wendell - 1890
 Mrs. Millbank - 1928
 Neilsoni - 1889

- Ne Plus Ultra - 1890
 Neige et Cerise - 1889
 Ochroleucum - 1889
 O Old Port - hardy 1889
 Olmsted, F. L. - 1895
 Papilionaceum - tender 1905
 O Parson's Gloriosum
 O Parson's Grandiflorum
 Pelopidas - 1895
 Penjerrick - tender 1928
 Picturastum - 1890
 Prince of Wales - 1889
 Princess Christian - 1889
 Princess Louise - 1889
 O Princess Mary of Cambridge
 1893 - tender
 O Princess Victoria - 1889
 O Prof. F. Bettex
 P. Simon - 1895
 Purity - 1893
 O Purpureum Elegans - hardy 1905
 Purpureum Grandiflorum - hardy
 1905
 O Purpureum splendens
 Queen - 1889- tender
 Ralph Saunders - 1889
 Richard Wallace - 1889
 Robert Marnock - 1889
 Rosabel - 1889
 O Roseum Elegans - hardy 1905
 Roseum Grandiflorum - 1905
 Saint Simon - 1889
 Samuel Morley - 1889
 Sappho - 1895 - tender
 Scarlet Prince - tender 1928
 Scipio - 1889 - tender
 Sefton - 1895
 Sherwoodianum - 1889
 Shilsoni - tender 1928
 O Sibeliu
 Sigismund Rucker - hardy 1889
 Silvio - hardy 1890
 Sir Arthur Guinness - hardy 1890
 Sir Joseph Whitworth - 1890
 Sir Robert Peel - 1889
 Sir Thomas Ackland - 1889
 Sir Thomas Seabright - 1889
 hardy
 Snowflake - 1889
 Souvenir 1889
 Stella - 1889 - tender
 O Sultana
 Sunshine - 1889
 Tippo Sahib - 1889
 Triomphe d'Angers - tender 1905
 O Van der Brocke
 O Van Weerden Porlman
 Varium - 1889
 Vauban - 1895
 Village Maid - 1892
 Warrior - hardy 1889
 O Waterer Gloriosum
 W. E. Gladstone - 1889
 O Wilhelmina
 William Austin - 1889
 William Cowper - hardy 1890
 William J. Penn - 1890
 William Minter - 1889
 †O Sciadopitys verticillata - 1867
 †O Spiraea henryi - since 1905
 O " miyabei - since 1905
 †O " trichocarpa - 1920
 †O " veitchi - 1907
 O Taxodium distichum - by 1880
 Taxus baccata - by 1905
 " " adpressa - 1905
 O " " aurea - by 1905
 " " fastigiata - 1847
 O " " repandens
 O " chinensis
 O " cuspidata - 1866
 " " densa - about
 1900
 §O Taxus media - about 1900



PLATE XVII

Taxus media hatfieldi originated in the Hunnewell Arboretum. This picture was taken by E. H. Wilson in 1929.

- §0 *Taxus media hatfieldi* - about 1900
 O *Thuja occidentalis* - 1870 ?
 " " *hoveyi* - 1867
 " " *meldensis* 1867
 Thuja occidentalis robusta - 1867
 O *Thuja orientalis*
 " *plicata* - 1867
 " *standishi* - about 1874
 O *Thujopsis dolobrata* - 1867
 O *Torreya mucifera* - by 1905
 O *Torreya taxifolia*
 O *Tsuga canadensis macrophylla*
 O " " *pyramidalis* 1902
 O *Tsuga caroliniana* - about 1895
 O " *chinensis*
 O " *diversifolia* - about 1900
 O " *heterophylla*
 " *mertensiana* - by 1905
 O " *sieboldi* - 1892
 Ulex europaea plena - 1847
 Ulmus campestris - 1847

Tree Measurements in feet, 1892-1949

(These are only a few of many recorded)

	<i>First Planted</i>	<i>1892 Ht.</i>	<i>1905 Ht.</i>	<i>1929 Ht.</i>	<i>1949 Ht.</i>	<i>Spread</i>
<i>Abies amabilis</i>	1882		5		25	20
" <i>brachyphylla</i>	1870	22	35			
" <i>cephalonica</i>	1860	42	51			
" <i>cilicica</i>	1870		49	59	82	30
" <i>concolor</i> (Colo. form)	1867	28	35	59		
" <i>holophylla</i>	1909			24	47	35
" <i>homolepis</i>	1880			54	69	
" <i>koreana</i>	1909				19	
" <i>lasiocarpa arizonica</i> After 1902					37	19
" <i>mariesi</i>	1880		9	20		
" <i>nephrolepis</i>	1914				35	
" <i>nordmanniana</i>	1860	42	59			
" <i>sachalinensis nemorensis</i>	1914				35	6
" <i>veitchi</i>	1880	15	32		52	
<i>Chamaecyparis lawsoniana</i>	1867		12			
" <i>obtusa</i>	1880	22	31		47	40
" <i>pisifera</i>	1880		32		56	40
" " <i>aurea</i>	1867	19	25			
" " <i>filifera</i>	1892		15'6"		45	50
" " <i>squarosa</i>	1880	20	29		50	45
<i>Ginkgo biloba</i>	1855		50		52	
<i>Larix eurolepis</i>	1913			30	60	
" <i>leptolepis</i>	1861	54				
<i>Picea abies</i>	1852	78	87		70	90
" <i>asperata notabilis</i>	1919				25	
" <i>bicolor</i>	1870	21	30		65	58
" <i>engelmanni</i>	1890		26		36	18
" <i>glauca</i>	1854		86		52	
" " <i>conica</i>	1909			5	12	

	<i>First Planted</i>	<i>1892 Ht.</i>	<i>1905 Ht.</i>	<i>1929 Ht.</i>	<i>1949 Ht.</i>	<i>Spread</i>
<i>Picea glehni</i>	1892		5		49	19
“ <i>jezoensis</i>	1890		17			
“ “ <i>honodensis</i>	1890		17			
“ <i>maximowiczii</i>	1895		11			
“ <i>koyamai</i>	After 1902				45	30
“ <i>mariana doumetti</i>	1900			17		
“ <i>omorika</i>	1890		16		41	20
“ <i>orientalis</i>	1867	33	49		64	23
“ <i>parryana</i>	1862		32			
“ <i>polita</i>	1880	17	34		57	
“ <i>pungens</i>	1862	33	39		69	
<i>Pinus bungeana</i>	After 1902			10	20	
“ <i>densiflora umbraculifera</i>	1902			10		
“ <i>banksiana</i>	1860		45			
“ <i>echinata</i>	By 1905				45	
“ <i>flexilis</i>	After 1902			22	37	
“ <i>koraiensis</i>	1870	22	38		35	29
“ <i>lambertiana</i>	1867	18	27			
“ <i>nigra austriaca</i>	1867		37			
“ <i>parviflora</i>	By 1905			20		
“ <i>peuce</i>	1894				29	
“ <i>resinosa</i>	1873		43		64	33
“ <i>strobilus</i>	1840	56	85	90	90	60
<i>Pseudolarix amabilis</i>	1867	21	35		54	50
<i>Pseudotsuga taxifolia</i>	1867	36	57			
<i>Sciadopitys verticillata</i>	?		14	21	31	
<i>Taxodium distichum</i>	By 1880		43	47	54	33
<i>Taxus media hatfieldi</i>	1914 ?				15	
<i>Thuja standishi</i>	1874	15	28	36	45	41
<i>Torreya nucifera</i>	By 1885			25	26	
<i>Tsuga canadensis</i>	1860		57	72	86	
“ <i>caroliniana</i>	1895			30		
“ <i>diversifolia</i>	About 1900				37	
“ <i>sieboldii</i>	1892		15		31	

DONALD WYMAN

This information has been obtained from the published and unpublished diaries of H. H. Hunnewell, Walter Hunnewell, Sr., Walter Hunnewell, Jr., from many published articles and unpublished notes of T. D. Hatfield, and from first hand information given by Mr. Walter Hunnewell, Jr., and his present superintendent, Mr. John Ellis.

INDEX TO VOLUME XII

Illustrations are in **bold face type**

-
- Abeliophyllum distichum, 46
Abies cilicica in Hunnewell Arboretum, Plate XVI, 76
— homolepis, 3
— koreana, 3
Acer circinatum, 3
— griseum, 3
— palmatum atropurpureum, 4
— platanoides columnare, 4
— — "Crimson King," 4
— rubrum columnare, 4
Albizzia julibrissin rosea, 4
Amelanchier laevis, 6
Arnold Arboretum, Field Class 1952, 44
— —, lecture on, 60
— —, Spring comes to the, 45-48
Autumn Color, 53-60
Autumn blooming shrubs, 59
Dull autumn coloration, 56
Why leaves are yellow, 54
Why leaves are red, 55
Woody plants with, 56-59
red, 57
reddish to reddish-purple, 58
yellow, 58
yellowish to bronze, 58
no autumn color, 58
Azalea "Louisa Hunnewell," 72
Azaleas, The flower colors of one hundred hardy, 41-44
Butternut and Hort. vars., 26-28
Carya laciniosa, Plate XI, 33
— and Hort. vars., 30-31
— alba, 30
— cordiformis, 30
— glabra, 30
— laciniosa, 30
— ovalis, 30
— ovata, 30
Castanea and Hort. vars., 31
— crenata, 31
— mollissima, 31
Cedrus libani, 6
Cercidiphyllum japonicum, Plate VI, 16; 8
Cercis canadensis alba, 8
Cherry, Oriental, "Fugenzo," Plate IV, 12
Chestnut and Hort. vars., 31-32
Cladrastis lutea, 56-57
Clematis paniculata, 59
Coggeshall, Roger, 46
Color, Autumn, 53-60
Colors of one hundred hardy Azaleas, The flower, 41-44
Colour Chart, Royal Horticultural, 41-44
Corylus and Hort. vars., 32-34
— americana, 32
— avellana, 32
— cornuta, 32
— maxima, 32
Crabapples, flowering, on Peters Hill, 46
Creech, John, 48
Elaeagnus angustifolia, 8
Ellis, John, 68
Elscholtzia stauntoni, 59
Evodia danielli, 8
Fagus sylvatica pendula in Hunnewell Arboretum, Plate XIII, 65

Field Class, Spring 1952, 44
 Filbert and Hort. vars., 32-33
 Fothergilla monticola, 55-56
 Franklinia alatamaha, 59
"Fugenzo," oriental cherry, Plate IV, 12
 Gardens, Best trees for Massachusetts, 1-20
 Gleditsia triacanthos "Moraine," 8
Halesia monticola, Plate IV, 12; 10
 Hamamelis virginiana, 59
 Harris, F. L., 67
 Hatfield, T. D., 67
 Heartnut and Hort. vars., 30
Hickory Nut, Plate XI, 33
 and Hort. vars., 30-31
 Hunnewell Arboretum, The
 1852-1952, 61-84
 Tree measurements, 83-84
 Trees and Shrubs introduced by, 75-83
 Trees and Shrubs listed in, 75-83
 Trees and Shrubs originated in, 75-83
 Hunnewell, H. H., 62
 Hunnewell, Walter, Sr., 66
 Hunnewell, Walter, Jr. 67
 Ilex pedunculosa, 10
 Juglans, 30
 — cordiformis and Hort. vars., 30
 — — aillantifolia, 30
Kalopanax pictus, Plate III, 9; 10
 Kodachrome slides on the Arnold Arboretum, 60
 Koelreuteria paniculata, 10
 Larix leptolepis, 11
 Lespedeza japonica, 59
 — thunbergi, 59
 Ligustrum ibolium, 48
 — obtusifolium, 48
 — — regelianum, 48
 Lipp, Lewis, 46

MacDaniels, L. H., 21-40
Magnolia denudata, Plate XII, 47; 11
 — **kobus**, Plate XII, 47; 45
 — **loebneri** "Merrill," Plate XII, 47; 45
 — **proctoriana**, Plate XII, 47
 — **salicifolia**, Plate XII, 47
 — **stellata**, Plate XII, 47; 45
 — stellata \times kobus, 45
 — virginiana, 11
Magnolias, Plate XII, 47; 45
 Malus "Dorothea," 11
 — hupehensis, 11
 — purpurea aldenhamensis, 13
 — — lemoinei, 13
 — toringoides, 13
 Merrill, Dr. E. D., 45
 Nut Growing in the Northeastern United States, 21-40
 Climatic Factors, 22-24
 Cross Pollination, 38
 Cultural Practices, 34-36
 Fertilizers, 36-37
 Harvesting Nuts, 39
 Insect and Disease Troubles, 37-38
Map, absolute minimum temp., Plate VII, 23
Map, growing season, Plate VIII, 25
Map, July temp., 1926-1940, Plate IX, 27
 Species and vars., 26-34
 Summary, 39
Oxydendrum arboreum, Plate V, 14; 13
 Parrotia persica, 13
 Pecan and Hort. vars., 31
Phellodendron amurense, Plate II, 7; 15
 Picea asperata, 15
 — omorika, 15

Pinetum, The, 73
Pinus bungeana, 15
 — *thunbergi*, 17
Polygonum auberti, 59
Prunus avium plena, 17
 — *serrulata* "Amanogawa," 17
 — — "Fugenzo," Plate IV, 12; 17
 — — "Kwanzan," 17
Pseudolarix amabilis, 18
Rhododendron canadensis × *japonicum*, 72
 — *dauricum*, 46
Rhododendrons, hardy at Wellesley, 62
 — in Hunnewell Arboretum, 72
 — winter injury to, 46
 — and Azaleas, 78
 Royal Horticultural Colour Chart, 41-44
Sciadopitys verticillata, Plate I, 5; 18
 Shrubs, autumn blooming, 59
 — Some Winterkilling of Certain, 49-52
 — — injured, 50-51
 — — not injured, 51-52
Sophora japonica, 18
 Sources for trees, 2-3
 Spring comes to the Arnold Arboretum, 45-48
Stewartia koreana, 18

Styrax japonica, Plate V, 15
Syringa amurensis japonica, Plate VI, 16; 19
Taxus media hatfieldi, Plate XVII, 82
Thuja plicata 19
Topiary Garden in Hunnewell Arb., Plate XIV, 69
 Tree measurements,
 Trees, Among the Best Common, 19-20
 — for Massachusetts gardens, Forty-five of the best, 1-20
 — and Shrubs introduced by Hunnewell Arb., 75-83
 — and Shrubs originated in Hunnewell Arb., 75-83
 U.S. Plant Introduction Garden, Md. 48
 Walnut
 — Black and Hort. vars., 26-28
 — Japanese, 30
 — Persian and Hort. vars., 22, 28
Walnuts, Black, Plate X, 29
 Weeping Willow, 45
 — — leafing dates, 46
 Winter-Killing of Certain Shrubs, percentage of, 49-52
 injured, 50-51
 not injured, 51-52

